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ABSTRACT

The second year of a project to test whether student achievement in mathematics could be increased through restructuring the learning environment was evaluated. Seventh graders were randomly divided into classes receiving one of three instructional methods, all emphasizing individualized instruction: a team-teaching approach; a self-contained, one-teacher approach; and a technological approach using one teacher, one teacher aide, and programmed materials with 30 teaching machines (Didactors). The Stanford Arithmetic Achievement Test was used as a pretest and posttest. Results showed that the mean of the self-contained classes was significantly higher than the means of the team-teaching and the Didactor groups on arithmetic computations, concepts, and applications. The cost-benefit ratio of the self-contained classrooms was more positive than were similar ratios for the other two groups. There were no significant differences in pupil attitude toward arithmetic under any of the three approaches. This document also contains a list of behavioral objectives for the program, teachers' comments on instructional methods used, and observer reports. This work was prepared under an ESEA Title III contract. (DT)

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Final Evaluation Report
E.S.E.A. Title III Project
Exemplary Middle School Mathematics
Galion School System
Galion, Ohio August, 1972

BOWLING GREEN STATE UNIVERSITY

SE 016 404

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    a) K-12 subject matter areas — reading, math, science, etc.
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    d) Testing
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    i) Etc.
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9. Comprehensive guidance and testing programs.
10. Special Projects.

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FINAL EVALUATION REPORT

E. S. E. A. TITLE III PROJECT

EXEMPLARY MIDDLE SCHOOL MATHEMATICS

GALION SCHOOL SYSTEM

GALION, OHIO

PREFACE

The evaluators would like to take this means (and opportunity) to state some opinions and to offer verbal gratuities.

The Galion students are to be commended for their hospitality, frankness, openness, and behavior. The students were very cooperative. They are a group of young adults of which any community should be proud. Secondly, the parents of the students especially are to be commended. Without parents' approvals and trusts, no experiment can be successful. Thirdly, the Board of Education deserves special commendation. For experimentation to occur in a school system, there must be Board members who look upon the education process as an ever changing and dynamic system.

Special thanks are offered to the staff members -- we have yet to work with teachers who have greater concern for the education and well-being of children, and who show greater professionalism. The four teachers -- Mrs. Huguenin, Mr. Cook, Mr. Fullerton, and Mr. Sage -- taught their "methods" to the best of their abilities. Without a doubt, each became discouraged somewhere along the line -- with testing, with record keeping, with meetings, and other general constraints - but, the experiment did not suffer. As with the pupils, the Galion citizens have a right and a cause to be proud and respectful of these fine teachers. Not to be overlooked -- because her position, responsibilities, and services were as equally important and were performed with excellence -- is Mrs. Vee Jordan, Mr. Fullerton's cohort.

A service well-done and one that was very important to the project was completed by Mr. Don Halsey. The cost-benefit analysis was completed from data collected and supplied by Mr. Halsey.

And lastly, to Mr. Jack Shuck, we would like to extend our special thanks. He had to be the most concerned, energetic, and resourceful Title III Project Director in the State of Ohio! He made our jobs a pleasure--giving us morale boosts as equally high as those he claims we gave him.

August, 1972

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CHAPTER I

INTRODUCTION, PROBLEM, AND PROCEDURES WITH A REVIEW OF THE FIRST YEAR'S ACTIVITIES AND FINDINGS

I. Review of the First Year's Activities and Findings

A. Introduction

During the summer of 1970, the Galion City Board of Education, Galion, Ohio, received a two-year federal grant to develop a Junior High Exemplary Mathematics Program. The purpose of such a program was to determine whether student achievement in the area of mathematics could be increased through a restructuring of the learning environment. Another purpose was to provide an initial exemplary program which could serve as a model for the development of the total educational program for the present middle school.

B. Statement of the Problem (First as well as the second years of the Project)

Junior High math teachers and administrators, realizing the existence of problems in the area of junior high math--low student achievement, inadequate materials, and inadequate teaching methods--sought to develop a new mathematics curriculum that would include:

1. Team-Teaching plan, hereafter referred to as the Team-Teaching Approach.
2. Master-Teacher Aide concept, hereafter referred to as the Didactor Approach.
3. Self-contained, One-teacher procedure, hereafter referred to as the Self-contained, One-teacher Approach.

Utilization of programmed material and instructional technology was to be incorporated mainly in the Didactor approach. The primary intent of the study was to test the following hypothesis:

> There will be no significant difference with regard to growth in mathematics maturity of the pupils taught by the three approaches.

Secondary concerns of the study were to investigate possible interrelationships of pupils' arithmetic achievement and indexes of their intelligence, arithmetic attitudes, reading levels, and socio-economic standings. A cost-benefit analysis was also planned.

Pupils in the 1970-71 seventh grade (1st year of the Project) were randomly divided into one of three teaching approaches; a team-teaching approach of approximately 125 pupils, a self-contained, one-teacher approach of approximately 90 pupils, and a technological approach of approximately 125 pupils with one teacher, a teacher aide, and 30 Didactors. The self-contained approach was divided into three class sections and the other two approaches, the team-teaching and the technological approach, into four class sections each.

C. Review of the Procedures for the First Year (1970-71)

The following is a sequential description of the activities and procedures for the first year of operation:

1. July, 1970
    a. Notification of awarding of grant
    b. Obtained staff.
2. Summer, 1970
    a. Development of taxonomized behavioral objectives by the staff.

   b. Remodeled existing facilities--constructed facilities for the Didactor Approach.
   c. Started the production of teaching materials. (This production continued throughout the school year.)
   d. Ordered necessary hardware and software.
   e. Contracted for evaluation and curriculum assistance.
   f. Other activities.

3. Fall, 1970
   a. Orientation for community acceptance.
   b. Continuation of production of teaching materials.
   c. Ordered necessary standardized pretests and posttests.
   d. Constructed the attitude forms.
   e. Prepared random assignments for the seventh-grade pupils.
   f. Other activities.
4. January, 1971
   a. Administered tests to gather baseline data:
      1. Stanford Arithmetic Test
      2. Reading Test
      3. Arithmetic Attitude Forms
   b. Obtained I.Q. data from cumulative folders.
   c. Obtained index of Father's Occupations--cumulative folders.
   d. Approximately January 20, 1971--first day of the implementation of the three approaches to teaching junior high mathematics.
5. February-March, 1971
   a. Teaching program in operation.
   b. Continued development of teaching materials.

c. Visits by outside consultants.

d. In-process observations, conferences, evaluations, and decisions.

6. April, 1971

   a. Teaching program in operation.

   b. Continued development of teaching materials.

   c. In-process observations, conferences, evaluations, and decisions.

   d. Post-tests were administered:

      1. Second Project Test

      2. Alternate form of the Stanford Arithmetic Test

      3. Alternate form of the Stanford Reading Test

      4. An Arithmetic Attitude Test

7. June-July, 1971

   a. Continued development of teaching materials.

   b. Data analysis and writing of interim evaluation report.

D. Summary and Conclusions for the First Year

The following statement is taken from pages 83 and 84 of the Interim Evaluation Report (July, 1971) and it refers to the product evaluation of the four months of actual teaching under the experimental conditions:

> The analyses of the product data revealed no consistent and reliable superiority of one method group over another. The few significant differences found were generally in favor of the team-teaching group; however, these differences were not of the magnitude that one should put much reliance in their being true and stable. They could have occurred by chance (e.g. (1) two or three students obtaining many correct answers by guessing whereas 2 or 3 like students in another group guessed and obtained incorrect answers, or (2) the probability of a Type I error (rejecting a true null) is always that of the significance level).

If the 1971-72 data for the seventh graders as well as the eighth graders verify these significant differences, one would be in a better position to make conclusions without reservations.

It should also be noted that most of the significant differences that occurred were in the analyses where the pupils were blocked into several levels. When the standardized scores from the total groups of pupils were analyzed without any subgrouping, there were no significant differences between the means of the three groups, with the exception of the Second Project Test.

For all practical purposes, a pupil developed mathematical maturity as much in one method as another.

II. THE PRESENT REPORT WHICH PERTAINS TO THE SECOND YEAR OF THE PROJECT

A. Introduction.

The second complete year of the project began July 1, 1971, and ended June 30, 1972. The same teachers and methods were involved the second year as were the first. The 1970-71 seventh graders were now eighth graders and they continued studying mathematics in the same fashion as when they were actually seventh graders.

A new group of seventh graders came to the Middle School Building in the fall of 1971--were randomly assigned to the three methods--and formed the main sample for this report.

The evaluators wish to state that in their opinions the 1971-72 seventh graders and findings pertaining thereto should be used to determine the merits of the three approaches. (Findings pertaining to the 1971-72 eighth graders are presented in Chapter 3 also, but should not be judged of the same weight as for the 1971-72 seventh graders.)

The reasoning behind this statement is:

1. All personnel had at least four school months (January-May, 1971) to work out the "bugs" for the 7th grade math program (last year's 7th graders).
2. There were more materials already prepared for typical seventh graders than for typical eighth graders.
3. The 1971-72 seventh graders were naive to the experiment and tests--this is always positive in quasi-experimental conditions.

4. The Galion school personnel were informed that their major experimental efforts; if decisions had to be made, should be focussed upon the 7th graders.

B. Statement of the Problem

The problem as previously stated (pages 1 and 2) would also apply to the second year activities of the project. The evaluators wish to state that the Stanford Arithmetic Achievement Test should be the main criterion for judging the relative effectiveness of the three approaches. The reasoning follows:

1. The Stanford Test is recognized as containing items which most United States school systems claim as measuring objectives of their math programs.
2. It has been submitted to rigorous item analyses--also considered to be high in validity and reliability.
3. It has grade scores and normalization population.

C. Review of the Procedures for the Second Year

The following is a sequential, brief description of the activities and procedures for the second year of operation: (for a more complete log, see Chapter 2)

1. Summer - 1971
    a. Randomly assigned new 7th graders to methods--scheduled them into classes
    b. Program Development -- new production of programs and films
    c. revised Exemplary Mathematics Taxonomy

    d. (for a more complete discussion, see chapter 2)

2. September, 1971
    a. Pretesting
    b. Commenced teaching under the various approaches
    c. Staff meetings
    d. Consultants visits and/or on call
3. September, 1971 - May 1972
    a. Teaching under the various approaches
    b. Staff meetings (16+)
    c. Visitors to Galion (see chapter 2)
    d. Staff from Galion made visits to other schools (see chapter 2)
4. January, 1972
    a. Administered 1st project test
5. May 1, 1972
    a. Administered posttests
6. June, July 1972
    a. Analysis of data and final report

D. Organization of Remainder of Report

Chapter 2 presents teachers' logs, comments, a listing of prepared programs, record of visitors and meetings, and other process data.

Chapter 3 presents statistical analyses and findings for the achievement part of the study.

Chapter 4 presents the cost - benefit analysis of the project.

Chapter 5 presents a short summary and conclusion.

The various appendices present the non-standarized instruments, raw scores, and other related material.

CHAPTER 2

AN ACCOUNT OF TEACHERS' REACTIONS, PROJECT ACTIVITIES, AND PRODUCTION OF TEACHING MATERIALS

(PROCESS DATA)

This chapter of the final report includes the following:

A. A copy of the behavioral objectives developed for the project.

B. Copies of the teachers' summaries, programmers' summaries, and project director's summary of advantages, disadvantages, and other data related to the project.

C. A record of

1. A log of activities
2. Staff meetings, visitors, correspondence, etc.

D. Summary report of technical productions and purchases (both years of the project).

E. A comparison of Galion's 1967, 1969, and 1971 eighth graders on the Ohio Survey Test and mathematical ability in mathematics.

F. Copies (4) of Observers' reports - - (four B.G.S.U. Staff Members)

G. Summary of Chapter 2.

A

GALION PUBLIC SCHOOLS

GALION MIDDLE SCHOOL

EXEMPLARY MATHEMATICS TAXONOMY

E.S.E.A. - TITLE III - MATHEMATICS

1970

Revised July 1, 1971

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TAXONOMY OF EDUCATIONAL OBJECTIVES

Cognitive Domain

.00 KNOWLEDGE

- 1.10 Know Specifics (bit information)
- 1.11 Know Terms
- 1.12 Know Specific Facts
- 1.20 Know Ways and Means of Deal with Specifics
- 1.21 Know of Conventions
- 1.22 Know of Trends and Sequences
- 1.23 Know knowledge of Classification or Catagories
- 1.24 Know Criteria - Facts Principles for Judging
- 1.25 Know Methodology
- 1.30 Know of Universals and Abstractions
- 1.31 Know of Generalizations
- 1.32 Know Theories or Structure

2.00 COMPREHENSION Lowest Level

- 2.10 Translation
- 2.20 Interpretation
- 2.30 Extrapolation

3.00 APPLICATION

4.00 ANALYSIS

- 4.10 Analysis of Elements
- 4.20 Analysis of Relation - Conective Links
- 4.30 Analysis of Organizational Principles

5.00 SYNTHESIS

- 5.10 Production Unique Communications
- 5.20 Production Plan
- 5.30 Derivation of set of Abstract Relations

6.00 EVALUATION

- 6.10 Judgement of Internal Evidence
- 6.20 Judgement of External Criteria

7.00 ENLIGHTENMENT

- 7.10 Human Interaction
- 7.20 Divine Source

An observation on Bloom's Taxonomy of Educational Objectives.

It would seem some general misunderstanding has crept into our conceptions concerning taxonomy - due no doubt to the true meaning of the word. The correct meaning is:

> Taxonomy - The study of the general principles of Scientific Classification. "Orderly classification of plants and animals according to their presumed natural relationships."*

The following quotations are from the "Overview of Taxonomy Project". Chapter 1, Taxonomy of Educational Objectives Classification of Educational Goals Handbook II: Affective Domain.

> "Some critics contended, that we did not have a true taxonomy, but only a useful way of discribing and defining classes of educational objectives."
>
> "Less severe critics suggested that many of our readers would not understand what taxonomy meant and the word would produce more confusion than was desireable."

A concise meaning of Taxonomy of Educational Objectives would be:

> "The authors started with a large list of cognitive objectives, behavorial definitions and evaluation material and investigated various methods of ordering them." (in accordance to difficulty).

The authors in no way wishes to construe that taxonomy would outline a course of action or determine instructional method other than relegating mental difficulty in numerical steps.

---

* Webster's Seventh New Collegiate Dictionary.

TAXONOMY OF EDUCATIONAL OBJECTIVES

NUMERATION

1.10 Identifies mathematical symbols (equal, not equal, greater than, less than).

1.32 Recognize and be able to reproduce decimal classification structure from 10 thousandths to billions.

1.10 Writes a series of 10 consecutive cardinal numbers from any starting point.

1.32 Ranks non-negative integers correctly in ascending or descending order using number line.

2.10 Reads written numbers and identifies with correct decimal form up to and including one million.

1.25 Counts by 2's, 3's, ... 10's forward and backwards from any starting point.

2.10 Pictorially represents whole numbers of less than 100 either individually or in a short series.

2.10 Reads and writes short sequences of numbers to 500.

1.32 Identification of even and odd numbers.

1.24 Conversion of decimals to fractions.

1.20 Conversion of common fractions to decimals.

1.20 Rounds numbers to nearest 10 thru 1,000,000.

2.10 Writes at least 4 place numbers in words.

2.20 Converts decimal fractions to fractions and vice-versa.

2.20 Writes number values for fractions to 1,000ths and vice-versa.

2.20 Orders mixed numbers and decimals between .001 to 100.

1.24 Tests any number for prime or composite.

1.24 Finds prime factors of composite numbers.

1.30 Writes base 2, 5, and 8 conversions for numbers up to 500, base 10 and vice-versa.

SEVENTH GRADE
SEQUENTIAL TAXONOMY OF EDUCATIONAL OBJECTIVES

MINIMAL	AVERAGE	ENRICHMENT
	1.12 Writes and reads Roman Numerals up to 2000.	1.32 Identifies a set, element, member.
.10 Pictorially represents whole numbers of less than 100 either individually or in a short series.		1.32 Identifies equivalent set and non-equivalent set.
.10 Writes a series of 10 consecutive cardinal numbers from any starting point.	1.25 Counts by 2's, 3's,...10's forward and backwards from any starting point.	2.00 Changes from the roster method to the rule method, and vice versa.
1.32 Ranks non-negative integers correctly in ascending or descending order using number line.	2.10 Reads written numbers and identifies with correct decimal form up to and including one million.	1.32 Identifies a finite, infinite, and null set.
	2.10 Writes at least 4 place numbers in words.	1.10 Uses the symbols correctly, $\{\}$, $\in$, $\notin$.
	1.32 Recognize and be able to reproduce decimal classification structure from 10 thousandths to billions.	1.10 Uses symbols correctly, $\subset$, and $\subseteq$.
1.10 Identifies mathematical symbols (equal, not equal, greater than, less than).		1.32 Identifies a proper and improper subset.
1.32 Identifies even and odd numbers.		1.32 Identifies universal set.
1.32 Restructures numbers in sums of multiples of 1's, 10"s, 100's, etc.		1.32 Identifies "intersection" of a set and use the symbol $\cap$, to write intersect of sets

MINIMAL	AVERAGE	ENRICHMENT
1.25 Writes cardinal numbers for given sums of multiples of 1's, 10's, 100's, etc.		1.32 Identifies union of a set and uses the symbol , to write union of sets.
	1.20 Writes expanded notation up to 1,000,000.	1.32 Identifies disjoint set.
	1.20 Writes exponential notation for any given number up to 1,000,000.	1.32 Identifies complement of a set.
	1.20 Writes value from exponential notation, base 10.	1.32 Pictorially represents union, intersection, and complement of a set with the Venn Diagram
	1.20 Writes numbers up to 1,000,000 for given expanded notation.	
		1.12 Writes place value for a digit of any given number in base 2, 5, and 8.
		1.20 Writes value in base 10 from exponential notation in base 2, 5, and 8.
		1.30 Writes base 2, 5, and 8 conversions for numbers up to 500, base 10 and vice versa.
		3.00 Makes a place value chart for any base.
		1.25 Adds in base 2, 5, and 8.
		1.23 Multiplies numbers in base 2, 5, and 8.
	1.20 Rounds numbers to nearest 10 thru 1,000,000.	

MINIMAL	AVERAGE	ENRICHMENT
1.32 Identifies addends and sums.		
1.10 Recognizes all addition combinations from 1 + 1 to 10 + 10.		
1.20 Identifies pictured addition statements with correct addition fact.		
1.10 Uses the word indicated by the symbols +, -, =, ≠.		
1.20 Completes addition of numbers without carrying.		
1.25 Completes addition of numbers with carrying.	1.25 Doubling 2 digit numbers with mental carrying.	
1.24 Corrects incorrect addition statements.		
1.20 Checks sums of numbers.		
1.23 Fills in missing numbers in addition statements.		
3.00 Solves word problems involving addition.		
1.32 Identifies minuends, subtrahends, differences.		
1.10 Has knowledge of basic subtraction facts 1 -1 thru 20 -20.		
1.20 Subtraction involving up to 7 digit natural numbers.		

MINIMAL	AVERAGE	ENRICHMENT
1.20 Subtraction involving up to 7 digit natural numbers with borrowing.		
3.00 Solves word problems involving subtraction.		
1.10 Knows multiplication facts up to 10 x 10 (with time drill).	1.10 Identifies terms multiplicand, multiplier, product and factor.	
1.32 Repeated addition will duplicate multiplication.		
1.20 The student will be able to multiply two numbers containing no more than three digits each.		
	1.20 Multiplies two numbers with less than five digits each.	
	1.20 Multiplication involving more than 2 factors, each factor having less than four digits.	2.10 Short cut multiplication (i.e. 5's, doubles, ten, 11's).
1.32 Checks multiplication.		
1.12 Fills in missing multipliers.	2.10 Solves one step multiplication word problems.	
	2.20 Solve multiple step multiplication problems, taken from written context.	2.20 Develop model of $(a+b)^2$ to find square root.
	1.25 Finds squares of numbers (up to three digits).	
	1,23 Uses table to find squares and cubes.	

MINIMAL	AVERAGE	ENRICHMENT
	1.23 Uses table to find square root.	1.25 Finds square root for values involving four digits on each side of decimal.
1.10 The student will be able to properly use the division symbols /‾‾ ÷ / .	1.10 Repeats subtraction to duplicate division to quotient less than 15.	
	1.10 Identifies divisor, dividend, quotient and remainder.	
1.20 The student will be able to divide a four digit number by a two digit divisor, with remainders written in fractional form.	1.20 The student will be able to divide a six digit dividend by by a four digit divisor, with remainders written in fractional form reduced to lowest terms.	
1.12 Writes missing terms in division.		
1.20 Checks division.		
1.20 Uses short division methods for division with one digit divisors.		
	2.10 Finds solutions to one-step story problems in division.	
	1.25 Comprehends order of mathematical operations.	1.20 Identifies order of operations in a mixture of basic mathematical functions.
		2.20 Solves word problems with two or more steps involving division and multiplication.
1.25 Calculates averages with no more than 10 items.		

MINIMAL	AVERAGE	ENRICHMENT
	1.31 Uses symbols in place of numbers.	2.00 Given a word problem the student will be able to translate it into an equation.
1.20 Inserts + or - to complete equations.	1.23 Solves simple equations of one variable using theory of equalities.	2.00 Solves one and two step equalities by applying the properties of inequalities.
	1.10 Supplies missing signs >, <, = or ≠ for combinations of +, -, x, or ÷.	1.32 Establishes basic algebraic products by drill and with pictures on rectangular field.
		1.32 Multiplies polynomials.
	1.24 Finds missing terms in D=RT problems.	
	3.00 Applies the distance formula to word problems.	
	1.30 Constructs number line and labels positive and negative numbers.	1.32 Comprehend establishment of negative numbers by subtractio i.e. $m < n$ then $m - n = a$ where $a < o$.
		1.30 Writes correct evaluation for double or multiple negatives.
	1.25 Adds negative numbers.	1.30 Adds positive and negative numbers.
		2.30 Comprehends subtraction is created when unlike signed numbers are added.
		1.32 Subtraction involving up to 7 digit natural numbers where negative numbers result.
		1.32 Uses Law of Signs to determine positive and negative results.

MINIMAL	AVERAGE	ENRICHMENT
		1.32 Multiplication using positive and negative powers with identical bases.
	3.00 Word Porblems.	1.32 Divides using like base numbers with negative or positive exponents.
	1.24 Finds prime factors of composite numbers with no factor > 7.	1.24 Tests any number for prime or composite.
		2.00 Uses divisibility tests.
1.11 Uses numerator and denominator to identify fractional parts.		
1.32 Identifies pictorial representations of common fractions, i.e. 1/6, 1/7, 1/8, 3/8, 3/4.		
2.00 Changes a fraction written in words to fractional notation.		
1.32 Identifies simplest form (lowest term).		
1.12 Changes fractions to equivalent fractions		1.21 Changes fractions to lowest terms using greatest common factor.
1.32 Identifies proper, improper, and complex fractions and mixed number.		
1.24 Identifies improper fraction and converts to mixed number.		

MINIMAL	AVERAGE	ENRICHMENT
1.21 Finds least common denominator in a short series of fractions.		
1.20 Doubles common fractions.		
1.12 Identifies 1/2, 1/3, 1/4, 1/5, etc. of a quantity.		
1.25 Adds fractions of same denominator to obtain small sums.		4.00 Finds the sum of fractions having variable (letters) as as numerators and denominators.
1.31 Adds and subtracts fractions with unlike denominators.		
1.24 Subtracts fractions and reduces to lowest terms.	1.21 Performs addition and subtraction of fractions of unlike denominators and changes to lowest terms.	
1.21 Adds and subtracts mixed numbers.		
1.20 Multiplies simple fractions.		
1.20 Finds fractional parts of whole numbers.		
1.32 Identifies reciprocal.		
2.00 Writes the reciprocal of any given fractions or mixed number.		
1.20 Performs division with simple fractions.		1.20 Simplifies compound and complex fractions.

MINIMAL	AVERAGE	ENRICHMENT
1.20 The student will be able to compare two fractions.	1.11 Uses $>$, $<$, $=$, $\neq$, to show relationship between fractions.	1.21 Performs multiplication of complex fractions.
	1.23 Rearranges groups of fractions in ascending or descending order.	1.20 Raises fraction to a power no greater than 5.
2.10 Solves simple fractional word problems.	2.10 Solves multiple step word problems.	2.10 Simplify the square root of given fractional radicands.
		1.20 Finds value of a whole number raised to a fractional power.
		3.00 sets up a correct proportion from a given word problem and solve for the answer.
1.22 Writes place value of digits from 10,000ths to 1,000,000.	1.10 Knows two place decimal equivalents from 1/2 = .50. 1/3 = .33-1/3, etc. thru 1/10 = .10.	
	1.21 Calculates and writes decimal equivalent to any fraction.	
1.20 The student will be able to compare two decimals.	2.20 Orders mixed numbers and decimals between .001 to 100.	
	1.20 Rounds numbers smaller than millions and greater than ten-thousandths.	
	1.20 Conversion of common fractions to decimals.	
	1.20 Converts fractions and their multiples to common decimal equivalents, i.e. if 1/2 = .50 the 3/2 = 3 x .50.	

MINIMAL	AVERAGE	ENRICHMENT
	1.24 Conversion of terminating decimals to fractions.	
1.20 The student will be able to add decimals.	1.25 Correctly adds decimals and whole numbers where 4 place decimals are used.	
1.20 The student will be able to subtract decimals.	1.20 Adds and subtracts mixed numbers and decimals where values are more than ten-thousandths and less than millions.	1.20 Subtraction involving 4 place decimals, positive and negative.
1.20 The student will be able to multiply decimals.	1.23 Divides by 2, 3, 4, 5 in order to multiply by 1/2, 1/3, 1/4, 1/5.	1.23 Writes numbers in scientific notation.
1.20 The student will be able to divide decimals.	1.32 Comprehends column of values in division and decimal form of quotients.	1.23 Addition of numbers written with scientific notation.
3.00 Word Problems.		1.32 Subtraction of quantities written in scientific notatio
		1.30 Multiplies using scientific notation.
		1.32 Divides using scientific notation.
	1.20 Conversion of fractions to percent.	
	1.20 Change percent to decimals and vice versa.	
	1.20 Changes per cent to fractions and vice versa.	
	1.32 Solves per cent problems.	

MINIMAL

1.20 Measures length to 1/16 inch using a ruler.

1.20 The student will be able to complete the table of English system linear measures
12 in. is 1 ft.
3 ft. is 1 yd.
36 in. is 1 yd.
5280 ft. is 1 mi.

AVERAGE

3.00 Word problems.

1.21 Solves simple interest problems.

1.25 Solves problems where manipulation of I=PRT is necessary.

3.00 Solves banking problems - checks, depositing, withdrawing money.

2.20 Changes a given linear measure to another unit in the English system using the following:
a, inch
b, foot
c, yard
d, rod
e, mile.

ENRICHMENT

1.32 Solves elementary compound interest problems.

1.22 Solves problems involving commission, overhead, operating expense and profit margin.

3.00 Solves stock and bond problems

3.00 Solves problems involving tax rate in mills per dollars.

3.00 Solves insurance problems - straight life, endowment insurance, etc.

1.20 Estimates distance in inches, feet and yards.

2.20 Changes linear measure from metric to English using the following tables:

1 in = 2.54 cm	1 cm = .39 in
1 ft = .31 m	1 m = 3.28 ft
1 yd = .91 m	1 m = 1.09 yd
1 mi = 1.61 km	1 km = .62 mi
1 lb = .45 kg	1 kg = 2.2 lb

2.20 Changes a given square measure to another unit in the English system using the following:
a, sq. inch
b, sq. foot
c, sq. yard
d, sq rod
e, sq. mile f, acre.

MINIMAL

AVERAGE

2.20 Changes a given dry measure to another unit in the English system using the following:
- a, cup
- b, quart
- c, peck
- d, bushel.

1.10 Identifies dozen and gross.

2.20 Changes a given fluid measure to another unit in the English system using the following:
- a, teaspoon
- b, tablespoon
- c, ounce
- d, cup
- e, pint
- f, quart
- g, gallon.

ENRICHMENT

2.20 Changes a given cubic measure to another unit in the English system using the following:
- a, cu. inch
- b, cu. foot
- c, cu. yard.

2.20 Changes a given linear measure to another unit in the metric system using the following:
- a, millimeter
- b, centimeter
- c, decimeter
- d, meter
- e, kilometer.

1.25 Reads distance on simple maps.

MINIMAL	AVERAGE	ENRICHMENT
1.20 Completes the table of English system of fluid measure: 2 pt = 1 qt 4 qt = 1 gal		2.20 Changes a given fluid measure to another unit in the metric system using the following: a, milliliter b, liter.
1.20 Completes the table of English system of weight measure: 16 oz is 1 lb 2000 lb is 1 T.	2.20 Changes a given weight measure to another unit in the English system using the following: a, ounce b, pound c, ton.	2.20 Changes a given weight measure to another unit in the metric system using the following: a, milligram b, centigram c, gram d, kilogram.
1.20 Completes the table of time measure: 60 sec is 1 min 60 min is 1 hr 24 hrs is 1 da 7 das is 1 wk 52 wks is 1 yr 12 mos is 1 yr.	2.20 Changes a given time measure to another unit in the English system using the following: a, seconds b, minutes c, hours d, days e, weeks f, months g, years.	
3.00 Word problems.		
	3.00 Applies use of the measures to word problems.	
	1.12 Reads and records thermometer readings.	2.20 Converts temperature, centigrade to fahrenheit, and vice versa.
	1.20 Labels plane construction.	
	1.12 Identifies curves, lines, segments,intersections and rays.	

MINIMAL	AVERAGE	ENRICHMENT
	1.32 Identifies and draws diagonals of a polygon.	
	1.10 Locates circle parts, center, radius, diameter, chord, arc, semicircle, tangent.	1.10 Identifies circle, square triangle, rhombus, parallelogram, trapezoid, rectangle, quadrilateral pentagon, hexagon, and octogon.
	1.25 Measures angles using protractor and identifies acute, obtuse, straight, supplementary, complementary and right angles.	2.20 Identifies intersections and applicable equalities and verticle angles, interior angles alternate angles, exterior angles, supplemental angles, and complimentary angles.
		1.31 Identifies 360° at all line intersections, 180° interior in triangles and 180° straight angles.
1.20 Identifies lines which look parallel.		
1.20 Identifies lines which look perpendicular.		1.12 Sketch accurately circle, square, triangle, rhombus, parallelogram, trapezoid, rectangle, quadralateral, pentagon, hexagon, and octogon
		1.32 Constructs and labels supplementary, complementary, obtuse acute, straight, and right angles.
		1.12 Constructs circles, bisects angles and line segments and constructs perpendiculars, equal segments, equal angles, equal circles and congruent triangles.

MINIMAL	AVERAGE	ENRICHMENT
	3.00 Finds perimeters for polygons by measuring.	
	1.12 Finds perimeters of parallelograms, rhombi, regular and irregular polygons.	
	2.10 Uses formulae for perimeter of square, rectangle, triangle, and circumference of a circle.	
	2.10 Uses area formulae for square, rectangle, triangle, and circle.	
		2.20 Uses pythagorean theorum for solving unknown linear measure.
		2.10 Finds areas of polygons using triangles with pythagorean application.
	3.00 Word problems.	
		2.20 Derivation of pi of a circle. $C = \pi D$ $C = 2\pi R$ $A = \pi R^2$
		1.12 Identifies sphere, cylinder, cube, cone, rectangular solid and pyramid.
		1.21 Makes representations of sphere, cylinder, cube, cone, pyramid and rectangular solid.
		2.10 Calculates surface area of prisms, cylinders, cones and pyramids.

MINIMAL	AVERAGE	ENRICHMENT
		2.10 Calculates volume of prisms, cylinders, cones and pyramids.
		3.00 Word Problems.
		2.20 Makes deductive conclusions from drawings.
		3.00 Uses inductive logic in simple exercises.
		3.00 Uses deductive logic in simple exercises.
		1.32 Locates points on a coordinate plane.
	2.10 Makes and reads graph charts.	
1.12 Writes time from clock face.		
1.12 States correct before and after minutes on a given clock reading.	1.24 Adds and subtracts time.	1.10 Reads a 24 hour clock.
1.12 Uses A.M. and P.M. in time announcement.		3.00 Identifies time zones, works problems requiring time changes.
.25 Draws minute and hour hands to show comprehension of written time.		3.00 Identifies the change which daylight saving time makes in solving time problems.
.12 Writes dates in words. (days, months and year)	1.10 Identifies calendar units, exact months and exact days.	3.00 Problems in reading bus, train, and plane schedules.
	1.11 Identifies decade, retain, score, century and leap year.	

MINIMAL	AVERAGE	ENRICHMENT
1.12 Changes decimal in determining ¢ to $ and vice versa.	1.10 Familiarity of +, -, >, <, =, ≠, in money, time and measurement.	1.23 Changes larger coins into smaller denominations readily.
1.20 Adds and subtracts money values.		
1.20 Finds sums and differences in money, measurements, time, and geometric size and shape where conversion is not needed.		1.24 Totals a collection of coins and determines if they amount to enough to buy an item of determined value.
		1.30 Totals purchases and makes change from $10 and $20 bills starting to count change from purchase price.
1.25 Multiplies and divides money correctly using decimal to determine dollars and cents.		2.00 Makes charts to compare U.S. currency with that of other countries.
2.10 Solves one step problems involving money.		1.23 Solves one and two step word problems time, money, measurement units, in numbers up to 1000.

B

1. Teachers' Remarks
    a. Team Teaching
    b. Didactor
    c. Self - Contained
2. Programmers' Remarks
3. Director's Remarks
4. Copy of Presentation Given at Northeast Ohio Math Teachers Association

B1a

FINAL SUMMATION OF TEAM-TEACHING

The major advantages that we felt in team-teaching are:

1. Each student works at his/her own rate. This allows the better student to reach new materials and to cover the old material more thoroughly (horizontal and vertical enrichment). The slower student is not pushed into new topics before he has mastered preparatory material. In either case the student will, if he/she asks, recieve answers to whatever questions he might have. In some cases we were able to assign good students to help slower ones if we felt that the personalities of the students were compatible.

2. We required a 91% or better to pass a post-test. If a student can achieve this score he is ready to go on to sequential material.

3. The students take post-tests when they are ready. They study the units and ask questions. When they feel they can do the problems we allow them to take post-tests. The students achieve someindependence in that they do not need to sit in class and listento the teacher. They can so the required work by themselves.

4. The students do not have to wait long to find out how they did on a post-test. We made it a point to grade post-tests as promptly as possible and to use the student's mistakes as

teaching devices in that we could point out errors and show how to correct those errors.

5. We had more time to spend with people who were having difficulty.

The major dis-advantages that we felt in team-teaching are:

1. With the large number of students (50 to 60 per period), we did not get to know everyone as well as we might have in a traditional class. The shy students were less apt to approach us about problems they were having. In some cases we had to seek out the student to make sure he was making progress. While this situation occurs in a traditional class it seemed to be more pronounced in our situation.

2. There is alot of record-keeping. We kept and filed all the tests that the students took. We used these tests and subjective judgement to arrive at our evaluation for each student. We spent much time filing and recording these grades to arrive at a fair evaluation. Since there was some subjective evaluation we had to justify to the students the marks which they recieved. This process (evaluation and justification) was time-consuming as we had to review each test the student took over the 9-weeks. In some cases it was worse for parents than students.

3. With a large number of people the classroom was noisy at times. The noise can bother students and cause other people to "see what is happening". The students and the teachers adjusted to the noise and were not as aware of it as some visitors.

4. Motivation of slow student was at least as difficult as in a traditional class. Even when given specific assignments the slower students would have to be prodded to gt to work. With the other students walking around, talking together, and partaking of the various activities in the room, the slower student felt he should be doing the same. We had to assign seats and not allow students out of those seats for certain people. These were the students who habitually forgot books, pencils, units, etc.

The over-all general statements we felt towards the whole program.

1. There should have been more developed in the area of story problems after a student completed a unit. This way he/she can learn more about the practical application of math by actually applying what has been learned.

2. It would have been benefical if we had more help writing the units when the program started. After the units were written, we had no indication how well they would work. It turned out that many of the units were wellwritten and some just did not have it. Therefore we rewrote several of them and are now very acceptable.

3. The majority of the students worked well in our class situation and were doing what was expected of them, even the under achievers were doing the minimum. But as in any classroom, several students failed to work at his/her ability level causing us to assign a seat to the student who would lose

the special privileges of the team-teaching class. We are not sure if this is the best way to handle these cases, but we are looking for other way to motivate these students.

4. We feel what was done in our class room has worked well and was so successful in the eyes of other schools, that Lexington Junior High School, Lexington, Ohio and Madison South Junior High School, Mansfield, Ohio, are reduplicating our material, which was written for the Galion Middle School, Galion, Ohio, (units and worksheets) in order to use our approach in their school system.

5. Both of us liked the team-teaching approach very much and would ~~difficultly~~ definitely like to continue it.

Respectfully yours,

David E. Sage
Walter L. Cook

B/b

OVERVIEW OF EXEMPLARY MATHEMATICS PROJECT 45-70-085

Didactor Instruction - Title III E.S.E.A. Galion Middle School

June 13, 1972.

Synopsis of 2 year project.

No doubt a better math job can be done!

This was the central idea of several influential citizens, board members, administrators and teachers to say nothing of parents and students; when Galion Schools hired me about four years ago.

Dr. Bernard Hill, then Superintendent, Mr. William Schramm, Elementary Supervisor, and Mr. Jack Shuck, Middle School Principal, and many others petitioned Title III to study the effects of Machine Instruction, Team-Teaching and Individual classroom mathematics instruction.

Our petition was finally approved in 1969-70 school year and all middle school mathematics, geared to central set of objectives, have been directed to this analysis since this date.

Positive Aspects of Machine Instruction

Michigan State University
It was a gratifying experience to be sent to Michigan for a short course in programming mathematics. Much of what was said their has come to pass. The Board of Education is to be thanked for their consideration.

Awaking Horizons
For the first time in my teaching career students were not forced to relearn material already covered. They could fill in the missing areas and progress at their own rate.

Friendships
Since grades as such are removed the student could approach his tasks without fear of grade evaluation. The instructors got to know the students and a mutual respect was evolved in many areas.

Teachers asked and Teachers paid
Our opinions were valued and the time spent in many cases was paid for through Federal funds.

Negative Aspects of Machine Teaching

Delays
Upon starting the project for evaluation; the work books were weeks late. In addition the necessary wiring for the Didactors was not completed on time. These delays were all set with fill in procedures , but did take the edge off the initial enthusiasm.

Programming at cross purpose

The teachers involved in team and traditional class instruction were originally asked to be major programmers. This caused them to bring their own philosophy into programmed instruction. Also by writing good program, they would make the comparison of their method more stringent on themselves. This cross purpose showed up on several occasions and no doubt led to obtaining programmers outside of the Middle School.

Student shirking

It was thought that if a student could be told what to do, he would get busy and do it. We have not found this to be so. We have found many Middle School students utterly without purpose and so immature to realize this as a fault. It is recognized now that individual daily conferences are a must in order to insure purpose or at least make it seem like purpose.

Vandalism

"Destroying what is not understood" is a famous quotation. The expensive machines became targets for destruction soon after our "dress code" was successfully attached by well intentioned, but I can not help but feel misguided , adults.

Recommendations

Individual Carrels

The Didactor was made for individual study. Grouping two or more at one machine plays into the hand of the poorly motivated student. Tom foolery in pairs has long been recognized.

Daily conference

The class size should allow instructor time for each student each day. Assigned tasks can be made and followed and student will know who is in charge.

Motivational awards

Our Sea World trip to award successful students was very popular. More trips, badges, and certificates etc. are needed for long sustained studies such as ours.

Thanks

It has been a great two years with a great director, Jack Shuck. If I can support him as he has supported me, my thanks would be realized.

Respectfully submitted;

D. O. Fullerton

B/c

Overview of Exemplary Math Project

Traditional Classroom

Bonnie L. Huguenin

Over the past two years I've tried various methods for teaching my students a better math. I tried individualizing in groups of 6 - 10 with work units and allowing each group to go at their own rate. This worked real well for a 9-week period. I also allowed one class to sign up for the grade they felt they could achieve and then work for it. This group was completely individualized, working at their own pace. They worked through the book and work units I prepared taking a test at the end of each unit when they felt they were ready. If they didn't receive the grade they had signed up for they had to go back and study the part they didn't understand and take a similar test again. I tried to have different projects with as many units as possible. These students covered more material than the classes I kept together, they made better grades, and most of them hardly ever had homework. They all seemed to enjoy this type of class very much and I would like to try it with future classes even though it was more work than a regular class. This group worked like this the last 20 weeks of this school year.

I also took the better students in one class and put them together to work as a group at their own pace. They did real well and accomplished much more than the rest of the class. I kept the rest of the class together. I found at the end of the school year that most of the class didn't like it because they weren't in the group that got to work ahead.

The 3 math houses I had at the beginning were fun and the students really enjoyed them; they also served as an excellent review over the basic plus being an incentive for many to like math. There were just enough though who ruined it for the rest that I didn't use the idea the second year.

The second year I fixed up shelves with boxes that contained cross-number puzzles, drawing pictures by doing coordinate graphing brain-teasers, filling out mail-order forms, etc. which served as extra credit, something to do when finished with the assignment, and just something to make math a little more interesting.

In the summer I made posters to help explain and teach math which I felt were real helpful in the classroom.

I am proud to have been a part of this math project and I feel it has been worth all the effort its taken to complete it. I'm just sorry I didn't have a chance to be a part of the team-teaching and the machine teaching phase. I feel that all three methods have their place in teaching students a better mathematics. Each student is different and some learn best in a traditional classroom, while others learn best in a team-teaching situation and still others learn best in a machine situation. I can also see where machines would be very helpful in a traditional classroom and also in a team-teaching class.

I am just sorry a test couldn't have been designed to measure the students growth in a real individualized situation. Our testing seems to consist of what all three methods taught during a specific time to the average number of students in their class. This didn't show the students who were way beyond the average number of students.

I feel that the math teachers involved in a testing program such as this should have more say in how the program should be set up.

I also think it would be helpful in having a longer period for the program and then have the teachers switch methods (the team-teacher take the traditional classroom, etc.)

Respectfully submitted by;

Bonnie L. Huguenin
Traditional Classroom Teacher

BLH/vee

B2

GALION EXEMPLARY MATHEMATICS PROGRAMS, GALION MIDDLE SCHOOL

Positive results

1. A certain amount of "enthusiasm" was evidenced in Middle School teaching personnel through the spirit of competition.
2. Middle School personnel discovered through the give and take of heated discussion over objectives and philosophy of the program that individual philosophies, idealogies, and pedogogy were not so far separated as previously supposed.

Negative Results

1. Middle School personnel were not always pleased with the way the program was written and the teaching situations into which they were forced by the conditions of the experiment. Teachers at times then may have disregarded the "experiment" in favor of "teaching the children" something. This of course, is to their credit that they felt it was more important to teach the children something rather than follow the conditions of the experiment. However, it does show a certain amount of non-confidence in what they were attempting and it may also invalidate the entire project results in the final evaulation.
2. From the beginning of the program, the administration seemed more interested in obtaining federal funds for "an" experiment. No matter what experiment had to be written in order to obtain these funds.
3. To the administrations' credit, Mr. Fullerton was sent (at local expense) to school for training in programmed instruction. It is interesting to note that the particular school chosen by administration was actively opposed to the type of programmed instruction to be used in Galion. So that the type of programmed instruction that Mr. Fullerton was exposed to may have been directly opposite the kind the education required by Didactics Corporation, and Jack Hanna's Didactor Machine.
4. I get the distinct impression that this experiment has separated Middle School mathematics from the entire structure of Galion mathematics instruction (at least for this two year period.)

   The Middle School program has seemed an island, entirely separated from the rest of our program.
5. The Federal Government seems to have been more concerned with following the original program and requiring paper work rather than getting the job done in a proper way. (Evidence the sound-mates written into the program which we felt were too involved for students to manipulate, and yet money could not be transferred into writers salaries where needed.)
6. We talked extensively about this being Galion's Program. And yet, I would hesitate asking the Federal Government to send money into a project in some far-away town without some guarantee that results would work in other locations.

Galion exemplary math program report cont.

Recommendations:

At the local level, everyone concerned needs to have a certain amount of confidence in what we are trying to accomplish. We need to think of this more as scientific rather than an educational experiment.

The best recommendation I can make overall is to remove (in so far as is possible)the worry of people involved in the program as to whether or not pay will be forthcoming.

We continually had to be concerned about our next pay check and whether the program had money to pay for work accomplished.

Otherwise we all did a fairly commendable job. I hope other results indicate the worthiness of the project.

Synopsis:

My general view is that everyone connected with the program attempted their best. A certain enthusiasm was experienced by the teaching staff involved.

It becomes extremely difficult to work for a program not knowing whether you will get paid for that work or not. And we were all laboring under this cloud.

I believe the program was worthwhile, but could be handled better.

Respectfully submitted;

Paul Richard Ramsdell

B2

OVERVIEW OF EXEMPLARY MATH PROJECT

Synopsis of two year project

To be able to keep the remarks of this report in proper perspective, it should be noted that the author did not become a contributor until the summer of 1971 and has been relatively isolated from the classroom activities because of teaching in another building.

The author's image of the objectives of the project could be verbalized as:

1) increase achievement at Galion Middle School in mathematics;
2) determine which of the three instructional approaches a) machine, b) team, c) traditional, stimulates and maintains the best attitude;
3) determine the comparable costs of the three approaches as projected over the long haul;
4) individualize instruction of mathematics at Galion Middle School;
5) determine to some meaningful extent how, why, and how much the achievement differs between relatively similar students in the different types of learning situations;
6) determine what kinds of topics, skills, or bits of information are learned most readily in each of the different types of learning situations.

If the author views the objectives of the project correctly, they are all of merit. Perhaps too many things are being considered to keep enough control factors constant. In order to eliminate variation of results due to differences among the instructors in; personality, organizational ability, and depth of mathematical background, it might be desirable to rotate the assignments of teachers among the three approaches.

Positive aspects of project

The single greatest attribute of this project has been the stimulation of interest in mathematics education in Galion, Ohio. The students are interested in the progress they are making and how that progress compares with the friends who have another type of instruction. They are concerned about which method is best.

Adults in the community are interested in what is happening. The mathematics teachers who have been directly involved have had many experiences during their work in the project which should strengthen each, and if nothing else, make each aware that his or her way is not the only way - there may even be a better way! Other teachers in the system are also enthusiastic about the prospect of having seventh and eight grade mathematics shed its label of the waste years. Parents of the students involved have wanted to know what was happening; and they have been told. Even school critics those people in the community who have no family in school and therefore see no reason why they should be saddled with school taxes, have been favorably

Synopsis report cont.

impressed by the ample publicity showing the desirability of the project.

Any effort, by use of the scientific method, to obtain information which can be used to improve instruction certainly must be considered highly desireable.

Negative Aspects of Project

All mathematics teachers vary in personality, organizational ability, depth of mathematical background and choice of emphasis in the subject matter presented. It would have been more desireable to have had a group of teachers who were more in agreement about these variable qualities for the ideal teacher. It is also apparent through conversations with the teachers involved that at least one of them has lost enthusiasm for that persons assigned type of instruction.

The complexity of the equipment and the nature of students in this age group combine to lead the author to question the advisability of relatively unsupervised use by students - as well as life expectancy and long term maintainence cost projections.

It seems questionable to have so many changes in project director.

The last objection to be included is the greatest. In order for the project to be meaningful, sufficient data must be obtained.

In the opinion of the writer, a project of this type should have minimum life of five years. The more data, the better.

Suggestions

Continue the project for several more years. Amplify the results by including reports of any similar experimental work. Establish a group including elementary and high school teachers to evaluate the project in terms of the total mathematics educational program in Galion. Entertain the possibility of changing the vehicle used in the machine instruction portion of the project (other types of programmed materials are available) . Rotate teachers among the types of instructional approaches.

Respectfully submitted;

Everett Springer

B-3

GALION CITY SCHOOLS

GALION, OHIO
44833

ROBERT A. HEDRICK
Superintendent

OVERVIEW OF EXEMPLARY MATH PROJECT
AT GALION MIDDLE SCHOOL
GALION, OHIO
JUNE 20, 1972

Synopsis:

Quite an experience! Math headaches from students, parents, and teachers seemed to be a part of the daily schedule. This became a real concern at the Galion Junior High School five years ago. It was very difficult to identify just what these problems or concerns might be. The concerns seemed to be with us daily and in no way did it appear that we were resolving these problems.

We began to categorize - modern math vs. traditional - outdated math textbooks - transient society or community we live in with engineers from foreign countries, many different states or communities whose children had been successful with math - labor force where families have shifted and children have been handicapped by being in a multitide of schools - the math teaching taking place in our own elementary schools - psychological attitudes of our staff, believing that what we were doing could be done better with another media, etc. Math was not enjoyable to many concerned people in this community.

The real joy of putting people together, striving to overcome these problems is being able to look back and realize that whatever we attempted never seemed to be good enough. We continuously believed we can and could do better.

Recognition should be given to so many people who made this study possible. It is without hesitation that Dr. Bernard Hill, Superintendent of Schools, was the true inspiration to this study becoming reality. Efforts of Elementary Supervisor, Bill Schramm were instrumental to the thorough and total research that was to take place. Certainly the support of Dr. Lester Dickey, Superintendent Robert Hedrick and members of the Galion Board of Education cannot be forgotten.

To the people who really did the work, Master Programmer, Don Fullerton; Teachers and Writers, Bonnie Huguenin, Walter Cook, Dave Sage, and paraprofessional, Vee Jordan , a deep debt of gratitude goes for their total involvement throughout the two year study. These people extended themselves way beyond the hours of the day or allotted time to be financially paid to prove this project worthy and feasible as an acceptable Galion Middle School math program.

It certainly behooves us to recognize Dr. Irv Brune and Dr. Fred Pigge, Bowling Green State University, who carried us through times of mental anguish and turmoil. Both gave us the continued thrust towards a better math program.

Our evaluation coordinator, Dave Chandler, Principal of Renschville Elementary School, gave of himself more than a personal touch to this program by his own convictions that all evaluation would be done to the very best of his and other's ability. Under his capable direction, Dorothy Vose and Paul

Stineman, Middle School Counselors were devoting much of their services to carry through with this concept of giving of their very best.

The study was very fortunate to have Sharon Bryner, an elementary math teacher; Dick Ramsdell and Everett Springer from the Galion High School math department write program and add to our discussion in group meetings.

Recognition needs to be given to all the students who were a part of the study. It did mean much additional testing, many interrupted classes due to testing and visitors, flexibility in their daily scheduling, and many attitudes that could have been easily turned off toward math. This, to the best of my knowledge, did not occur.

Now is the time for research to bear out the following objectives of this study:

1. Did a significant increase to middle school students mathematics achievement occur?
2. Did students attitude toward the three mathematics teaching-learning approaches change?
3. Will the cost factor prove significant to this study?
4. Did we develop a math-learning environment whereby individualization of instruction could be measured by student performance?
5. Will there be a significant difference in the students math achievement growth among the three approaches?

It is hoped at this writing that the Galion Middle School can absorb the best of this study into an adoption as its math curricula.

Positive Aspects of Program:

1. Attitudes of students, parents and teachers have changed.
2. Teachers actively involved themselves into making the math curricula.
3. It created an interest to the English, Science, Social Studies teachers to explore into new media other than the traditional.
4. It created flexibility into our total staff due to testing, visitations, and scheduling of math.
5. Math teachers feel professionally important due to public meetings and presentations.
6. Educational fellowship and enthusiasm shared before and after public presentations.

Negative Aspects of Program:

1. The amount of necessary testing for evaluation disrupted school too much.
2. Paperwork with individualized program for both team and program instruction appears to overload teachers.
3. Project director needed to give more times to teachers in crucial moments of this study than was written into the proposal or available to the person due to dual role.
4. Public relation pamphlets or materials were not able to be developed due to time and money.
5. Teaching staff could not be convinced that a minimum set number of educational objectives should be expected of each student [illegible]

a 4 1/2 week or 9 week grade period. This was due to their belief of what an individualized program was to be.

Recommendations:

1. Permit the study to continue for another year with much of the testing delineated. Take the pressure of writing new program and making new materials away from the teachers. This would still mean no additional expense to the Board of Education.
2. Give 6th grade and 9th grade math teachers in our system a complete exposure to this study.
3. Use same student evaluation as we are presently doing but put on N.C.R. paper. Place marking on report for pass or fail when year is completed.

For the past two years math has been fun and enjoyable at Galion Middle School.

Respectfully submitted,

Jack B. Shuck

Jack B. Shuck
Principal, Galion Middle School
Project Director

B-4

North Central Ohio Math Meeting, Nov. 15, 1972, Galion, Ohio

by Richard Ramsdell

What can these Galion Middle School students expect when they finally get to Senior High?

For the first time the children will be given the opportunity to choose the type of mathematics course they prefer. For the general student who is not interested in persuing his educational opportunities past the secondary school level, 9th Grade General Mathematics is offered. For the college preparatory student, First Year Algebra is offered.

In so far as it is possible students at Senior High are grouped by ability upon teacher recommendations.

Since this exemplary mathematics program has just started, there is no way of knowing whether the students are any better because of it. Dr. Pigge of Bowling Green is studying the differences found in three different approaches to a mathematics curriculum. His study, however, does not include the comparison of thoses students who proceded this experiment whith those who are in the midst of the program.

If there is no significant difference in students coming through this mathematics experiment and those who preceded it, then we may properly expect the classroom teacher to make little or no change in his classroom teaching at the Senior High level.

On the other hand, let us assume, for the moment, that our exemplary mathematics program will be successful. Then we should expect each student to go just as far as he can at the highest level of accomplishment his ability will allow. Then I believe that we ought to expect every student who successfully completes this program to gain better understanding of the mathematics that he has studied, This would mean that the Senior High teacher should expect the low ability student to know what he knows with a better understanding, At the same time, the teacher should expect that the low ability student has been exposed to less mathematics because the student's rate of learning is less than average.

The Senior High teacher should expect the high ability student to know much more with a much higher level of understanding. This student will probably have been exposed to much more mathematics than any student previously coming from the Middle School.

So I foresee a better understanding of mathematics for all, but a wider gap between low and high ability students. So long as we continue to group by ability at Senior High, the classroom teacher will be able to adjust his teaching to the class. A testing program at the Middle School given to eigth grade students and designed to aid in grouping according to ability at the 9th grade level has been proposed by the Senior High teachers.

Experimentation such as what we find here indicates a basic knowledge on the part of the teacher that there is a need for improvement. Experimentation implies that teachers are seeking better methods and curriculums. What we see here at Middle School implies a real desire by the faculty and administration to improve the mathematics curriculum.

C

1. A log of activities prepared by project director

2. A record of staff meetings, visitors, correspondence, etc.

C-1

June 13, 1972

Mr. David Chandler, Principal
Renschville, Elementary School
Galion, Ohio 44833

Dear Dave;

These are the very brief notes I kept for you on the meetings, visitation of Galion personnel, visits from outside persons etc. Hope they will be helpful to you in your final evaluation.

July 20, 1971 David Chandler met with Dr. Fred Pigge, Bowling Green State University, Bowling Green, Ohio.

July 23, 1971 Teachers metwith Mr. Robert Hedrick to refresh his memory on different phases of the program.

August 9, 1971 Dr. Fred Pigge, and Dr. Ervin Brune presented results of evaluation study of first half year to the Galion Borad of Education.

August 27, 1971 Meeting with Mr. Shuck, Class organization.

September 13, 1972 Department meeting, discussion general,

September 15, 16, 17, 1971 students tested, Reading, Mathematics, apptitude.

September 22, 1971 Department meeting, discussion general.

September 27, Mr. Yoder, teacher from Medina, visited the Math department.

September 29, 1971 Dr. Bill Reynolds of Bowling Green State University visited re: cost analysis.

October 5, 1971 Department meeting discussion on open house plans for 7th grade parents.

October 11, 1971 Math open house for all 7th grade parents. Presentation by the three programs and Richard Ramsdell and Mr. Everett Springer.

October
~~November~~ 26, 1971 Open house for Middle School P.T.A.

November 9, 1971 Department meeting to discuss Northeast Ohio Math Teachers meeting to be held in Galion Middle School.

November 15, 1971 Math teachers met with Northeast Ohio Math Teachers Association, Galion Middle School, Galion, Ohio.

November 17, 1971 Department Meeting to discuss math honor roll for students since there are no grades.

December 8th, 1971 Math meeting with Supt. Robert Hedrick, regarding testing and what is the testing to be and conclusion was to call a meeting with Dr. Pigge, Dr. Brune, Mr. Hedrick, Mr. Chandler and Math teachers.

December 15, 1971 Frank Scott, Title III Office Columbus, Ohio regarding needs for the Title III Program.

December 17, 1971 Dr. Pigge, Dr. Brune, Mr. Hedrick, Mr. Chandler, Mr. Fullerton, Mr. Sage, Mr. Cook, Mrs. Huguenin, and Mrs. Jordan regarding testing. conclusion, Dr. Pigge and Dr. Brune will devise the final test, and the mid-term test. teachers are not to see this test.

Reports are requested for state on objectives covered on the following dates.

Sept. 8th - 22nd
Nov. 8th - 29th
Nov. 30th - Mar 15th
Mar 16th - June 8th.

These reports are to cover both 7th and 8th grade, consentrate on the 7th grade.

January 5, 1972 department meeting regarding testing date.

January 18, 1972 Mrs. Bonnie Huguenin and Mr. Sage visited Vermillion Jr. High School

January 20, 1972 Department meeting, Mr. Jack Shuck has been reinstated as project director.

January 27, 1972 Student Math tests.

Mrs. Bonnie Huguenin and Mrs. Vee Jordan visited Lexinton Jr. High School in A.M.

Mr. Walter Cook visited Lexington Jr. High School, P.M.

Mr. Walter Cook and Mr. Sage visited Madison South, Jr. High School, Mansfield, Ohio A.M.

Mr. D. O. Fullerton visited Sylvania Jr. High School, Sylvania, Ohio

February 18, 1972 Mr. Jack Shuck meeting with Title III people in Columbus, Ohio

February 20, 1972 Dr. Ervin Brune, and Dr. Ralph Martin, Bowling Green State University visited the three different classrooms.

February 22, 1972 Board of Education meeting held in the Middle School. Approximately 40 parents and 5 members toured the classrooms.

February 23, 1972 Math meeting with Mr. Jack Shuck, Mr. David Chandler, Mr. Paul Stineman, and Math teachers present. (Mrs. Jordan absent)

February 24, 1972 Jack Shuck visit with Dr. Fred Pigge, Bowling Green, Ohio

February 25, 1972 Teachers visiting in Galion as follows;
Miss Lois Anderson, Iberia Jr. High School, Iberia, Ohio
Mrs. Harriet Marrow, Iberia Jr. High School, Iberia, Ohio
Mr. Charles Ogg, Johnsville, Jr. High School, Johnsville, Ohio.

March 1, 1972 department meeting discussion on 7th grade objectives covered by june 1972.

March 3, 1972 department meeting, Mr. Shuck asked that reports of objectives covered to March 15th be turned in no later than March 22, 1972. Dawsett P.T.A. has asked the math teachers to present a program on Middle School math on April 11, 1972.

April 4, 1972 department meeting, general discussion. Final plans for the Dawsett P.T.A. program.

April 11, 1972 visitor from Lexington Jr. High School, Mrs. Emma Prichard, Lexington, Ohio

Dawsett P.T.A.

April 14, 1972 Dr. Fred Pigge and Dr. Ervin Brune, Bowling Green State University, Bowling Green, Ohio regarding observation reports on three math programs.

April 28 , 1972 Ray Worthington, Program consultant, Title III Office visited from Columbus, Ohio.

May 1, 1972 Mrs. Jean Bishop and Mr. David Cartwell, visited from Crestview Jr. High School.

May , 1972 John Fishpaw and 3 math teachers from Madison South Jr. High School visited.

May 2,1972 department meeting regarding math testing program, and reading and attitude tests. Final phasing out program.

May 24, 1972 department meeting reminded of June 8th objective reports. Also reports on over-all program.

Mr. Shuck will give teachers final instructions on report for him. Tentative report to be in 4 stages a) overview of program; b) positive points; c) negative points, what changes could be made; d)recommendations made.

June 5, 1972 department meeting. Final Phasing out, reports, and Thank you's.

It has been indeed a pleasure working in this program, and with the people involved. I hope these brief notes will help you in your end of the program.

Sincerely,

Vee Jordan

Vee Jordan

C-2

GALION EXEMPLARY MATH PROJECT, GALION, OHIO, GALION MIDDLE SCHOOL

MEETINGS, VISITATIONS, VISITORS, CORRESPONDENCE

JUNE 1971 through JUNE 1972

The following department meetings were held;

July 21, 1971
August 27, 1971
September 13, 22, 1971
October 5, 1971
November 9, 17, 1971
December 8, 1971
January 5, 20, 1972
February 23, 1972
March 1, 3, 14, 1972
April 4, 11, 1972
May 2, 24, 1972
June 5, 1972.

The following Mathematics Meetings held for the Public;

August 9, 1971 - Dr. Pigge and Dr. Brune met with the Galion Board of Education

October 11, 1971 Open House for all 7th grade parents 150 present. (flyer encl.)

October 26, 1971 P.T.A. Open House 400 present (flyer encl.)

November 15, 1971 Northeast Ohio Math Teachers Assoc. 35 present (Ramsdell speech encl.)

February 22, 1972 Board of Education met in Middle School 40 parents present 5 board members present

April 11, 1972 Dawsett P.T.A. Math presentation by Middle school. 60 present (Ramsdell speech encl.)

Meetings, cont.

The following visitations were made by Galion Teachers

January 18, 1972. Mrs. Bonnie L. Huguenin and Mr. David Sage visited Vermillion Jr. High School, Vermillion, Ohio

June 27, 1972. Mr. Walter Cook and Mr. David Sage visited Madison South Jr. High School. Mansfield, Ohio

Mrs. Bonnie Huguenin and Mrs. Vee Jordan visited Lexington Jr. High School, (A.M.) and Mr. Walter Cook Visited in the P.M., Lexington, Ohio

Mr. Donald Fullerton visited Sylvania Jr. High School, Sylvania, Ohio.

Letters encl.

The following people visited Galion Middle School Math Program

September 27, 1971. Mr. Yoder, Asst. Principal Medina Schools, Medina, Ohio

September 29, 1971. Dr. William Reynolds, Bowling Green State University, Bowling Green, Ohio

December 15, 1971. Mr. Frank Scott, Title III Office, Columbus, O

December 17, 1971 Dr. Fred Pigge, Dr. Ervin Brune, Bowling Green State University, Bowling Green, Ohio

February 20, 1972 Dr. Ervin Brune, Dr. Ralph Martin, Bowling Green State University, Bowling Green, Ohio

February 25, 1972 Miss Lois Anderson, and Mrs. Harriet Marrow of Iberia Jr. High School, Iberia, Ohio and Mr. Charles Ogg, Johnsville Jr. High School, Johnsville, Ohio.

April 11, 1972 Mrs. Emma Prichard, Lexington Jr. High School, Lexington, Ohio

April 14, 1972 Dr. Fred Pigge, and Dr. Wm. Kirby, Bowling Green State University, Bowling Green, Ohio

April 28, 1972 Ray Worthington, Title III Consultant, Columbus, Ohio

May 1, 1972 Mrs. Jean Bishop and Mr. David Cartwell, Crestview Jr. High School.

May , 1972 John Fishpaw, Principal and 3 math teachers from Madison South, Schools, Mansfield, Ohio

June16, 1972 Dr. Copes and 5 principals from Cleveland Catholic School.

D. SUMMARY REPORT OF TECHNICAL PRODUCTIONS AND PURCHASES

July, 1970 - September, 1971

(last page in this section
lists those additions since September, 1971)

posed Programs	Completed Programs	Shelf Programs
Read Roman Numerals	Roman Numerals ST-1	
Read Large Numbers	Place Value of Whole Numbers NUM-R-1	Intro. To Arith. (36512100)
Rounding Nos.		
Add. of Whole Nos.	Combine Signed Nos AG-1	How to Add Simple Nos. (36604100)
	Add Integers AG-2	How to add Lg. Nos. (36605100)
	Grouping Nos. A-2	
	How to Add Accurately C-2	
Sub. of Whole Nos.	Sub. w/ borrowing SR-1	Sub. Simple Nos. I (36604200)
	Subtracting w/o Borrowing SR-2	Sub. Simple Nos. II (36605200)
	Subtracting Integers SG-1	
Multiplication Whole Nos.	Doubling Nos. D-1-1	Mult. Drill I (37003100)
		Mult. Drill II (37003200)
		How to Mult. Simp Nos. (36605400)
	Nult of Signed Nos. M-H-2	How to Mult. Lg. Nos. (36605500)
Div. of Whole Nos.	Div. by grouping Obj. D-1	Div. Drill I (37004100)
	Division D-D1B	Div. Drill II (37004200)
	Finding Missing Factor D-D2	How to divide simple Nos.I (36605600)
	Dividend, Divisor, Quotient D-D3	How to divide simple Nos. II (36605000)
	Divide Simple Nos. D-D4	How to divide Lg. Nos. I (36606100)
	Div. Inv. zero and One D-D5	How to divide Lg. Nos. II (36606200)
	Spec. Prob. in Div. D-D6	

oposed Programs	Completed Programs	Shelf Programs
	One Step Story Problems D-D7	
	Div. Simple Nos. D-E1	
	Div. w/ Lg Dividends D-E3	
	Intro to Remainders D-E4	
	Lg. Div. w/ Remainders D-E5	
	Check Div. casting 9's AMDR-1	
	Checkd Div. D-E7	
Changing Impr. Fract.	Fract. of An Object FR-2	
Reducing Mix Nos.		
. Raising Fractions	Equiv. Fractions FR-3	Fractions Drill I (37004100)
		Fractions Drill II (37004200)
. Find Common Denominator		
. Add Fract. and Mix Nos.	Word Problems Add and Subt. FR-8	Common Fract. (Add & Subt) (36605800)
. Subtraction of Fract.		
. Comparing Fractions	Comparing Fract. FR-9	
. Chang Mix Nos to Impr Fract.	Mix Nos to Impr Fract. FR-4	Common Fract. (mult and div) (36605900)
	Word Problems Mult & Div FR-6	
. Div. of Fractions		
. Find Fract. Parts	Find what part one no is of another FR-10	
. Div. of Fract.		
. Find whole When Fract is known.		
. Read and Write Decimals		How to read, write Dec. (36606300)
. ~~Wxxk~~ Rounding Decimals		Work w/ Dec. (367032001)

oposed Programs	Completed Programs	Shelf Programs
. Add. Decimals		
. Subt. Decimals	Subt of Decimals SG-1	
. Comp Dec.	Compar of Decimals PVR-6	
. Mult Dec.		
. Div. Decimals	Div Signed Nos. D-H-2	
. Mult & Div by 10, 100, 1000		
. Common Fract to Dec.	Fractions to Dec. ST-4	Dec. Equivalents (36606500)
. Dec. to Common Fract.		
. Mix Fract. w/ Dec.		Using Add, Subt and Learning percent thru auto repair (37008100)
. Dec. to Percent		
. Percent to Fract.		
. Fract. to Percent		
. Percent of a number		Ratio, Proportion, Percent and percentage (36703300)
. Percent a no is of another		
. Find No when percent is known. =		
. Find Square Root	Finding Sq. Roots D-H-4 Powers & Roots using tables D-H5	
. Linear Measure		Introd. Perimeter and area Prob (3 & 4) (37009200)
. Area Measure	Similar Triangles	Circle Basics & Prob. in circum. area (37010300)
	Exercise Triangles	
	Pythagorean THeorem D-H4-2	
		Ident & discov. 4 sided figs plus perimeter & area (37009400)
		Pyramid Area & Volume (37011100)

oposed Programs	Completed Programs	Shelf Programs
		Solids, Rectang. Prisms Cu. Vol. (37010200)
		The Circle Dia Rad Circun (37010100)
		Trapezoid and Triangle Area & Perimeter (37011200)
. Volume Measure		Triangular Prism Area & vol (37011300)
. Cap. Liquid		
. Capacity Dry		
. Time		
. Conversion Wts Meas.		
. Compound Nos.		
. Metric System		W.U.T. Metric (36701119)
. Measure Angles & Area		W.U.T. Temp. (36608219)
		Light Year WUT (36607219)
		Scientific Notation (3660711
		How to read Sclaes (36604300
		Beg. work w/ equat.(16603100
		Slide Rule (16511100)
		Meaning of Equations (36701100)
		Binary Numbers (36701300)
		Conv. Between No Systems factoring (36609100)
		Alg. Fractions (36610100)
		Quadratic Equat. (36701200)
	Brackets Braces and Parenthese STR-7	Introd to Algebra (36606600)
		Alg. Expressions I (3660710
		Alg. Expressions II (3660810
		Rectangular Coordinaus (37003300)

Proposed Programs	Completed Programs	Shelf Programs
	Sine, Cosign Tnagent	Introd. to Trig. (37003400)
		Exponential Numbers (16510100)
		Imaginary and Complex Numbers (36611100)

GALION MIDDLE SCHOOL

July 14, 1972

The following Didactor films were added to the math library shelf at Galion Middle School as part of the Title III Exemplary Math Program since September 1971.

Code Number	Title	Quantity
16 512 103	Introduction to Magnetism and Electrostatics	1
16 603 103	Ohm's Law - Part I	1
16 604 103	Introduction to Transisters	1
16 604 203	Introduction to Transisters - Part II	1
16 606 203	Ohm's Law - Part II	1
16 606 303	Introduction to Semiconductors	2
16 606 403	Introduction to Semiconductors - Part II	1
36 605 200	How to Subtract Simple Numbers - Part II	1
36 605 300	How to Subtract Large Numbers	1
36 606 200	How to Divide Large Numbers	1
36 607 103	Fundamental Concepts of Electricity - Part I	1
36 607 203	Fundamental Concepts of Electricity - Part II	1
36 607 303	Fundamental Concepts of Electricity - Part III	1
36 607 403	Fundamental Concepts of Electricity - Part IV	1
36 608 119	What's Up There! The Moon Man-Made Satellites	1
36 610 200	Exponents & Radicals	2
36 701 114	Grammer Nouns-Common Proper - Number Gender	1
36 701 400	Binary Number	1
36 702 219	What's Up There! The Manufacturing of a Space Mobile	1
36 702 319	What's Up There! What Keeps it Up There?	1
36 703 103	Introduction to Contact Networks	1
36 704 100	Boolean Algebra - Part I	1
36 707 402	Telling Time	1
36 710 102	Changing Velocity is Acceleration-Tracking a Satellite	1
36 710 302	What's Up There! More About Time	1
37 003 500	Division Drill	4
37 003 600	Division Drill II	3
A-2	Grouping Numbers - Add	1
AC2	How to Add Rapidly & Accurately	1
AG-1	Combining Signed Number	1
AG-2	Addition of Integers	1
AMDR	Casting Out 9's	1
AMDR 4	Checking Division by Casting Out 9's	1
D 1	Doubling Numbers Multiplication	1
D 2	Sine, Cosine, & Tangent	1
DD1	Introducing Division by Grouping Objects	1
DD1B	Division by Repeated Subtract	1
DD2	Finding Missing Factors - Division	1
DD3	Dividend, Divisor, Quotient	1

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COLUMBUS OHIO 43212

January 6, 1972

Section E

Mr. Fred Pigge
College of Education
Bowling Green State University
Bowling Green, Ohio 43403

Dear Mr. Pigge:

As I indicated in our telephone conversation, the eighth grade Ohio Survey Tests in mathematical ability and mathematics achievement for 1967, 1969, and 1971 are exactly the same.

Sincerely yours,

E Roger Trent

E. Roger Trent
Assistant Supervisor
OHIO TESTING SERVICES

ERT:ht

SECTION E

A COMPARISON OF GALION'S 1967, 1969, AND 1971 EIGHTH GRADERS ON THE OHIO SURVEY TEST AND MATHEMATICAL ABILITY IN MATHEMATICS

The exact same tests were administered to all three groups of students in the fall of the year. (See Appendix). The 1967 and the 1969 groups were not exposed to any of the innovative practices as was the 1971 group. The 1971 group was exposed for approximately five school months to the exemplary program, from January 1971 to June 1971. The primary purpose of this section is to report the results of testing the hypothesis that the three achievement group means did not differ significantly when the ability scores were held constant by analysis of covariance. Table 1 presents raw data and the summary table for the total groups of students. Tables 2, 3, and 4 deal respectively with the high, average, and low ability students.

It can be observed from data presented in Table 1 that the ability mean for the 1971 students was less than the mean for the 1969 students. It can also be observed that the ability mean for the 1969 students was less than the ability mean for the 1967 students. It can also be observed from data presented in Table 1 that the 1967 group has the highest achievement mean, that the 1969 group had the second highest achievement mean, and that the 1971 had the lowest achievement mean which is 25.1. Taking into consideration that the three groups differed on ability, using the ability scores to predict achievement scores, it can be observed that the adjusted achievement means for the 1967, 1969, and 1971 groups were 27.0, 26.5, and 26.0, respectively. The analysis of covariance summary table shows an F value of 1.72, which has to be judged insignificant. In other words, it was not as high as 3.01 which was the tabled value of F with 2 and 800 degrees of freedom.

It can be observed from data presented in Table 2 that the high ability students for the three years did not differ significantly with respect to the arithmetic achievement means. There were 52, 62, and 70 high ability students for the 67, 69, and 71 years respectively. High ability was defined as having ability scores of 75 and above. Table 2 implies that the achievement means for the three years were 38.17, 36.60, and 35.49. The adjusted means, it can be observed from Table 2, were 37.63, 36.50, and 35.97. The analysis of covariance summary table implies an F of 1.09 which is insignificant. This F would have had to be, as implied in the footnote below Table 2, 3.05 or higher for it to imply a significant difference between the three adjusted means. It can be concluded that as far as high ability students are concerned, there was no significant difference between the three achievement means for the three years involved in this section of the report.

Table 3 is very similar to Table 2, however, Table 3 deals with average ability students only. Average ability was defined as scores of 50 to, but not including, 75. As can be observed from data presented in Table 3, there were 111, 148, and 138 average ability students for the three concerned years. It can also be observed from Table 3 that the achievement means were 26.76, 26.30, and 25.00. The adjusted means can be observed to be 26.59, 26.09, and 25.36. Table 3 also implies another insignificant F ratio. The F was computed to be 1.53 and it would have had to be 3.02 or higher for a significant difference to be implied among the three adjusted means.

Table 4, like Table 3, presents basic data and the analysis of covariance summary table for a sub group of students. This sub group is classified as the low ability students. Low ability was defined as scores of 49 and below. It can be observed in Table 4 that there were 33 pupils in the 1967 group with scores of 49 and below, 76 in the 1969 group, and 107 in the 1971 group. The unadjusted achievement means as implied in Table 4 were 18.79, 19.01, and 18.36 for the three concerned years. The adjusted means were 18.75, 19.04, and 18.36. Table 4 also presents an insignificant F value of 0.40. This F value would have had to be 3.04 or higher for a significant difference to be implied.

In summary, it can be concluded that there is no significant difference between the total groups and the various sub groups defined as high ability, average ability, and low ability students for the 1967, 69, and 71 academic years. The data would seem to imply that the ability of the students progressed downward from 1967 on. It can be observed, especially from Table 1 dealing with the total groups of students, that the ability mean scores were 64.3, 60.7, and 58.4 for the three years. Saying it differently, the 1971 students do not seem to have the ability that the 1967 students had, but taking this into consideration, they are achieving as well as the 1967 students.

TABLE 1

BASIC DATA AND ANCOVA SUMMARY TABLE--TOTAL GROUPS OF STUDENTS

Group	N	Ability		Achievement			ANCOVA SUMMARY					
				Obtained		Adjusted						
		$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	Source	df	SS	M.S.	F	Decision*
1967	196	64.3	15.9	28.4	8.8	27.0	Between	2	115.3	57.6	1.72	N.S.**
1969	285	60.7	16.6	26.6	8.7	26.5	Within	793	26505	33.4		
1971	316	58.4	17.0	25.1	8.9	26.0						

$F_{2,800}$ = 3.01 @ .05

TABLE 2

BASIC DATA AND ANCOVA SUMMARY TABLE--HIGH ABILITY* STUDENTS ONLY

Group	N	Ability		Achievement			ANCOVA SUMMARY					
				Obtained		Adjusted						
		$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	Source	df	SS	M.S.	F	Decision*
1967	52	82.98	5.72	38.17	5.71	37.63	Between	2	81.30	40.63	1.09	N.S.**
1969	62	82.16	4.92	36.60	6.55	36.50	Within	180	6694.79	37.19		
1971	70	81.10	5.21	35.49	7.55	35.97						

* High Ability--Scores of 75 and above

** $F_{2,180}$ @ .05 = 3.05

TABLE 3

BASIC DATA AND ANCOVA SUMMARY TABLE--AVERAGE ABILITY* STUDENTS ONLY

Group	N	Ability		Achievement			ANCOVA SUMMARY					
				Obtained		Adjusted						
		$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	Source	df	SS	M.S.	F	Decision*
1967	111	62.96	7.34	26.76	6.42	26.59	Between	2	95.81	47.90	1.53	N.S.**
1969	148	63.05	7.46	26.30	6.90	26.09	Within	393	12287.69	31.27		
1971	138	61.76	7.26	25.00	5.95	25.36						

* Average Ability Scores of 50 to, but not including, 75.

** $F_{2,393}$ @ .05 = 3.02

TABLE 4

BASIC DATA AND ANCOVA SUMMARY TABLE--LOW ABILITY* STUDENTS ONLY

Group	N	Ability		Achievement			ANCOVA SUMMARY					
				Obtained		Adjusted						
		$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	Source	df	SS	M.S.	F	Decision*
1967	33	39.27	8.62	18.79	3.76	18.75	Between	2	20.94	10.47	0.40	N.S.**
1969	76	38.91	7.05	19.01	4.64	19.04	Within	212	5524.45	26.06		
1971	107	39.08	6.64	18.36	6.03	18.36						

* Low Ability--Scores of 49 and below

** $F_{2,212}$ @ .05 = 3.04

F

Copies (4) of observers' reports...(four B.G.S.U. staff members)

The following people made the observations:

1. Dr. Irvin Brune
   Professor of math education
   B.G.S.U.

2. Dr. William Kirby
   Professor of mathematics
   B.G.S.U.

3. Dr. Ralph Martin
   Assistant Professor of math education
   B.G.S.U.

4. Dr. Fred L. Pigge
   Director of Research and Services
   B.G.S.U.

OBSERVER'S REPORT
GALION MATH PROJECT

OBSERVER'S NAME____ DATE___________

POSITION____

ADDRESS____

1. Check the most appropriate phrase which indicates your reaction as to the students' motivation and interest in learning junior high mathematics. The phrases appear below:

   A. Approximately 80% or more of the pupils appeared to be engrossed in their work most of the time.

   B. Between 60% and 75% of the pupils appeared to be interested in the work most of the time.

   C. Between 35% and 55% of the pupils appeared to be interested in the work most of the time.

   D. Very few pupils seemed to be truly interested and motivated.

TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH
___A	___A	_X_A
___B	___B	___B
_X_C	_X_C	___C
___D	___D	___D

Supporting written comments:

Except those working on tests in the team and didactor classes, too many of the students seemed disinterested and poorly motivated.

OBSERVER'S REPORT
GALION MATH PROJECT

OBSERVER'S NAME________________________________ DATE__________

POSITION________________________________

ADDRESS________________________________

1. Check the most appropriate phrase which indicates your reaction as to the students' motivation and interest in learning junior high mathematics. The phrases appear below:

   A. Approximately 80% or more of the pupils appeared to be engrossed in their work most of the time.

   B. Between 60% and 75% of the pupils appeared to be interested in the work most of the time.

   C. Between 35% and 55% of the pupils appeared to be interested in the work most of the time.

   D. Very few pupils seemed to be truly interested and motivated.

TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH
___A	___A	___A
_X_B	___B	_X_B
___C	_X_C	___C
___D	___D	___D

Supporting written comments:

Could have been an "off" day for the didactor approach - much test taking and waiting for the results.

OBSERVER'S REPORT
GALION MATH PROJECT

OBSERVER'S NAME____ DATE__________

POSITION____

ADDRESS____

1. Check the most appropriate phrase which indicates your reaction as to the students' motivation and interest in learning junior high mathematics. The phrases appear below:

    A. Approximately 80% or more of the pupils appeared to be engrossed in their work most of the time.

    B. Between 60% and 75% of the pupils appeared to be interested in the work most of the time.

    C. Between 35% and 55% of the pupils appeared to be interested in the work most of the time.

    D. Very few pupils seemed to be truly interested and motivated.

TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH
___A	___A	___A
X B	X B	X B
___C	___C	___C
___D	___D	___D

Supporting written comments:

The above ratings hover nearer the lower limit of the B rating.

The genuinely interested people in the team-teaching situation kept the instructor more than busy.

In all three classes some of the pupils, say two of every five, seemed unable to keep their minds on the seatwork they were supposed to do.

1. Check the most appropriate phrase which indicates your reaction as to the students' motivation and interest in learning junior high mathematics. The phrases appear below:

   A. Approximately 80% or more of the pupils appeared to be engrossed in their work most of the time.

   B. Between 60% and 75% of the pupils appeared to be interested in the work most of the time.

   C. Between 35% and 55% of the pupils appeared to be interested in the work most of the time.

   D. Very few pupils seemed to be truly interested and motivated.

TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH	
___A	___A	___A	
X B	X B	X B	55-60
___C	___C	X C	
___D	___D	___D	

Supporting written comments:

1. In comparison with other elementary, middle, and junior high schools I have visited, the above percentages are quite high. Thus, the letter ratings are not to be construed as grades.

2. The classes I observed were:

Team Teaching - 8th Grade
Didactor - 8th Grade
Self-Contained - 7th Grade

I suspect that part of the difference in the above ratings might be attributed to the difference in maturity level between the two grades. It seemed that the eighth graders had more self-discipline. It might be, however, that the team teaching and didactor approaches tend to promote self-discipline more than the self-contained approach does.

2. Describe the use of class time.

   A. Very efficient -- very little waste of time and effort.

   B. Moderately efficient -- a more efficient use could be made of class time.

   C. Low efficiency -- a considerable waste of class time.

	TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH
	___A	___A	X A
	X B	X B	___B
b	___C	___C	___C

Supporting written comments:

This is a difficult item to judge because efficiency of use of class time really should be measured in terms of accomplishment rather than as indicated above. For the relatively small time we spent in the classrooms, this item seems to aim at the same thing as item #1 on the first page.

2. Describe the use of class time.

   A. Very efficient -- very little waste of time and effort.

   B. Moderately efficient -- a more efficient use could be made of class time.

   C. Low efficiency -- a considerable waste of class time.

TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH
X A	A	X A
X B	X B	B
C	C	C

Supporting written comments:

I will be interested in going back in a few weeks and checking these opinions in more detail.

2. Describe the use of class time.

   A. Very efficient -- very little waste of time and effort.

   B. Moderately efficient -- a more efficient use could be made of class time.

   C. Low efficiency -- a considerable waste of class time.

TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH
___ A	___ A	___ A
X B	X B	X B
___ C	___ C	___ C

Supporting written comments:

In the team approach the workers plied both teachers with numerous questions. The takers of tests worked as pairs (or triples) instead of individually. About one in five did not work.

In the didactor approach the contrast between individual work (more than half of the machines were idle) and lecture (how to do calculations) was a bit ironic. Most pupils chose the lecture.

In the self-contained approach, the new development went smoothly, but the group discoveries got lost in the pupils' socializing in about three fourths of the small groups.

2. Describe the use of class time.

   A. Very efficient -- very little waste of time and effort.

   B. Moderately efficient -- a more efficient use could be made of class time.

   C. Low efficiency -- a considerable waste of class time.

TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH
___A	___A	___A
X B	___B	X B
___C	X C	___C

Supporting written comments:

Much of the material being used in the didactor room tended to promote rote learning as opposed to learning with meaning. I feel that student time could be more profitably spent in learning concepts and principles of mathematics. In all three classrooms, more time should be devoted to problem-solving activities.

3. Describe the use of teaching materials and equipment.

A. Excellent

B. Good

C. Average

D. Below average

E. Poor

TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH
___A	___A	___A
X B	___B	X B
___C	___C	___C
___D	X D	___D
___E	___E	___E

Supporting written comments:

Didactor: 8th graders made little use of the didactors; the 7th graders were taking a test but indicated much better utilization of the machines.

Team-Teaching: Those students who were applying themselves were using the units prepared by the instructors (and some were taking unit achievement tests which were also prepared by the instructor).

Self-Contained: These students were working from a commercial text.

3. Describe the use of teaching materials and equipment.

A. Excellent

B. Good

C. Average

D. Below average

E. Poor

TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH
___A	___A	___A
___B	___B	___B
_X_C	_X_C	_X_C
___D	___D	___D
___E	___E	___E

Supporting written comments:

3. Describe the use of teaching materials and equipment.

   A. Excellent

   B. Good

   C. Average

   D. Below average

   E. Poor

TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH
___ A	___ A	X A
___ B	X B	___ B
X C	___ C	___ C
___ D	___ D	___ D
___ E	___ E	___ E

Supporting written comments:

In the team teaching there seemed to be plenty of drill sheets, but not enough materials to encourage pupils to want to learn mathematics. At least it was dry drill that nearly all were doing.

In the didactor classes the pupils appeared to have tired of the drills on the films. Various progress charts seemed to have lost their power to motivate further work with the programs.

In the self-contained class the opportunity to use appropriate drawing and measuring tools was apparent, but somehow the pupils (in a class where boys outnumbered the girls) feigned participation only when the teacher was nearby.

3. Describe the use of teaching materials and equipment.

   A. Excellent

   B. Good

   C. Average

   D. Below average

   E. Poor

TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH
___A	___A	___A
X B	___B	X B
___C	X C	___C
___D	___D	___D
___E	___E	___E

Supporting written comments:

In both the team teaching and the self-contained classroom, the students had "enrichment" material. Very few students used these materials during the period of observation.

It would be helpful if all rooms were equipped with materials designed to stimulate thinking and promote problem-solving ability and teachers would make an effort to encourage students to use them.

4. How did the teaching method meet, in your subjective opinion, individual differences?

   A. The needs of nearly all pupils were met.

   B. The needs of approximately 3/4 of the pupils were met.

   C. The needs of approximately 1/2 of the pupils were met.

   D. The needs of less than 1/2 of the pupils were met.

TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH
___A	___A	___A
___B	___B	___B
___C	___C	___C
___D	___D	___D

Supporting written comments:

Self-Contained: Does not have the flexibility of the others, although there was a group of five working separately from the others in one class.

Didactor and Team-Teaching: These have the potential to accommodate individual differences better than self-contained. So many students seemed not to be using their time well, however, that these approaches might better be limited to those who display some sense of self-discipline. Both types of approaches showed a wode range of student achievement (in the records of the instructor) that would be difficult to provide for in a self-contained classroom.

4. How did the teaching method meet, in your subjective opinion, individual differences?

   A. The needs of nearly all pupils were met.

   B. The needs of approximately 3/4 of the pupils were met.

   C. The needs of approximately 1/2 of the pupils were met.

   D. The needs of less than 1/2 of the pupils were met.

TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH
___A	___A	___A
_x_B	_x_B	_x_B
___C	___C	___C
___D	___D	___D

Supporting written comments:

4. How did the teaching method meet, in your subjective opinion, individual differences?

   A. The needs of nearly all pupils were met.

   B. The needs of approximately 3/4 of the pupils were met.

   C. The needs of approximately 1/2 of the pupils were met.

   D. The needs of less than 1/2 of the pupils were met.

TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH
A	A	X A
X B	B	B
C	X C	C
D	D	D

Supporting written comments:

All three methods failed to handle individual differences as one would expect them to do in an experiment designed to help individuals. It seemed that most pupils on this day were tired on the didactors, unwilling to work diligently on the team teaching worksheets, and uninspired to make the self-contained discoveries that the teachers seemingly had prepared them to do. The sheer weight of numbers in the didactor and team-teaching sections appeared to militate against the teachers' achieving what they were striving to do - encourage all pupils to do their best in learning mathematical skills.

4. How did the teaching method meet, in your subjective opinion, individual differences?

   A. The needs of nearly all pupils were met.

   B. The needs of approximately 3/4 of the pupils were met.

   C. The needs of approximately 1/2 of the pupils were met.

   D. The needs of less than 1/2 of the pupils were met.

TEAM TEACHING APPROACH	DIDACTOR APPROACH	SELF-CONTAINED CLASS APPROACH
___A	___A	___A
_X_B	_X_B	_X_B
___C	___C	_X_C
___D	___D	___D

Supporting written comments:

The above ratings refer to how well the methods meet the need of the students. I have already expressed my reservations about the content.

In all three classrooms, there were provisions made for above average students. By allowing students to advance at a slower pace, the team teaching and didactor approaches made provisions for slower students.

5. What evidence of effective and conscientious teacher planning (as well as cooperative project planning) did you observe? (Perhaps you will need to separate the two in your written comments below.)

The two less orthodox approaches require considerable teacher effort in preparing materials. As noted earlier, the self-contained class had five students working ahead of the others, seemingly without much teacher direction and yet they worked interestedly.

6. In a capsule statement, what is your personal reaction to the project and its activities?

The idea of the project is admirable. It is perhaps unfortunate that expectations of students achievement were set rather low. There seemed to be little in the students' work not normally accomplished by the end of grade six. The materials mught well have benefitted from a more contemporary approach with more attention to the "ways" and to structure.

5. What evidence of effective and conscientious teacher planning (as well as cooperative project planning) did you observe? (Perhaps you will need to separate the two in your written comments below.)

Much evidence of teachers planning for their own students -- did not detect, to any great extent, cooperative methods wide planning efforts.

6. In a capsule statement, what is your personal reaction to the project and its activities?

Team teaching and self-contained, sticking to original plans -- "newness" and "machine motivation" tend to be wearing off in didactor approach.

5. What evidence of effective and conscientious teacher planning (as well as cooperative project planning) did you observe? (Perhaps you will need to separate the two in your written comments below.)

In all three situations, the teachers probably had worked hard to prepare an abundance of drill materials. All worked untiringly, moreover, to help pupils who followed the plans and encountered difficulties en route. The self-contained situation provided more flexible, day-by-day planning, which the teacher did. All teachers seemed to be conscientious.

Evidence of cooperative project planning did not abound. The situation was more like three quite separate projects, each aiming in its own way, to teach items best suited to its style.

6. In a capsule statement, what is your personal reaction to the project and its activities?

The project and its activities will probably improve pupils' skills. From the outset it has appeared that the teachers see their task as helping their pupils to perform numerous computing tasks. Why the operations work and when to use the operations receive much less emphasis than how to operate. Whether the pupils will learn how to learn mathematical reasoning and applications to problem solving seems to be an unresolved question.

5. What evidence of effective and conscientious teacher planning (as well as cooperative project planning) did you observe. (Perhaps you will need to separate the two in your written comments below.)

In the team teaching and didactor rooms, a great deal of planning had to be done prior to the start of the school year. There was little evidence (and probably little need) of daily planning beyond the initial preparation of materials.

In the self-contained room, the daily lesson seemed to be well-planned.

6. In a capsule statement, what is your personal reaction to the project and its activities?

The project seems to be progressing well in that the goals, as outlined in the brochure, are being met. These goals, however, relate mainly to skill development. I would prefer to see more done with problem-solving activities.

G. Summary of data presented in chapter 2

Chapter 2 consisted of bits and pieces of information - - the purpose of which was to give the reader an overview of the problems, successes, productions, etc. related to the project. Its purpose also was to present data which verified that the staff lived up to process expectations as so stated in the project proposal.

In summary, the evaluators would like to state that the teachers and staff met the process objectives as stated in the original proposal in a quite satisfactory manner.

The basis for the above statement is from an assimilation of data from various sources, among which were the following:

1. Materials presented in chapter 2, Sections A, B, C, D, and F of this report.
2. On-site classroom visitations, observations, and pupil-staff interviews by the evaluators (noted in section F).
3. Various staff-consultant conferences and seminars.
4. Relayed reports of positive reactions from parents.

Chapter 2 more-or-less summarizes the processes--Chapter 3 will deal with the product evaluation.

CHAPTER 3

PRESENTATION OF THE FINDINGS

Introduction

This chapter is divided into several sections, namely

1. Analysis of Intelligence Quotients for Grades 7 and 8(ANOV)
2. Whole Group Analyses (ANCOVA--grades 7 & 8) of the
    a. Stanford Arithmetic Test
    b. Stanford Reading Test
    c. Various Attitude Scales
        1. Test A Toward Arithmetic
        2. Test A Toward Teaching Machines
        3. Test A Toward Future Math Courses
        4. Test B (Dutton) Toward Arithmetic
    d. Project Test
    e. Item Analysis for Project Tests
3. Analyses (ANOCOVA) by I.Q. Levels for grades 7 & 8
    a. Stanford Arithmetic Test
    b. Project Test
4. Analyses (ANCOVA) by Reading Level for grades 7 & 8
    a. Stanford Arithmetic Test
    b. Project Test
5. Analyses (ANCOVA) by Social-Economic-Standing for grades 7 & 8
    a. Stanford Arithmetic Test
    b. Project Test
6. Analyses (ANCOVA) by Attitude Levels for grades 7 & 8
    a. Stanford Arithmetic Test

b. Project Test

7. Status Report of the students' grade equivalents at end of 1971-72 school year in arithmetic and reading

8. Summary of the Findings

The findings will be presented in the same order as indicated above. The major findings will be presented in table form--succinct narratives will then be attached to each table.

1. ANALYSIS OF INTELLIGENCE QUOTIENTS FOR GRADES 7 & 8 (ANOV)

Table 1 (top) shows that mean I.Q.'s for the three sections of the 7th grade students were 102.84, 103.75, and 104.98. The F-ratio of 0.79 implies that the three means did not differ significantly. The same conclusion may be stated regarding the mean I.Q.'s for the 8th graders. Table 1 more-or-less implies that the various within grade-level classes were equivalent in regards to intelligence. Even though the classes differed numerically in I.Q., the major analyses held pretest scores constant--this damped whatever I.Q. differences actually existed.

It may be stated that the students in the three approaches were equivalent in regards to I.Q. The between approaches achievement differences that might have existed at the beginning of the year were equalized by a statistical technique called analysis of covariance (ANCOVA). Thus, the two main contributors to achievement (intelligence and academic background) were taken into account.

TABLE 1

BASIC DATA AND ANALYSIS OF VARIANCE SUMMARY TABLE

Intelligence Quotients

Seventh Grade

Basic Data				Analysis of Variance Summary Table					
Group	N	Means	S.D.	Source	df	SS	MS	F	Decision
1	111	102.84	12.18	Bet.	2	226	113.00		
2	112	103.75	11.39	Within	309	44305	143.38	0.79	N.S.
3	89	104.98	12.42	Total	311				

Eighth Grade

Group*	N	Means	S.D.	Source	df	SS	MS	F	Decision
1	113	104.35	15.26	Bet.	2	86	43.00		
2	110	104.10	13.63	Within	302	58095	192.37	0.22	N.S.
3	82	103.06	12.04	Total	304				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

2. WHOLE GROUP ANALYSES

A. Stanford Arithmetic Test

Table 2 presents data related to the computations section of the Stanford Arithmetic Test. The top of the page presents basic data and the ANCOVA summary table for the seventh grade. The bottom of the page presents similar data for grade 8.

For the benefit of the reader, a more thorough discussion will be presented for Table 2 than for the tables that follow. The reader may examine and read the subsequent tables in much the same manner as Table 2.

The top of Table 2 implies that 106 team-teaching students were pretested as well as posttested--that their pretest mean was 13.06 raw score points and the obtained posttest mean was 17.27. For the 110 didactor students, their pretest mean was 14.38 and the posttest mean was 17.67. For the 87 self-contained students, the pretest mean was 13.99 and their posttest mean was 19.64. It would have been unfair just to analyze the obtained posttest scores--the reader can readily observe that the three groups of students did not start the year with equal achievement levels (differing means of 13.06, 14.38, and 13.99). These pretest differences were taken into account with the ANCOVA analysis. The observed mechanics of applying the technique raised the posttest mean of the "least" prepared group (Group 1--from 17.27 to 17.86; lowered the mean of the "best" prepared group (Group 2--from 17.67 to 17.22) and lowered the mean of the third group because its pretest mean was closer to the "best" than it was the "least" prepared (from 19.64 to 19.50).

TABLE 2

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

Stanford Arithmetic -- Computations

(pretest, September; posttest, May

Seventh Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	106	13.06	17.27	17.86	Between	2	261	130.69	5.44	Sig.
2	110	14.38	17.67	17.22	Within	299	7181	24.02	$p < .01$	
3	87	13.99	19.64	19.50	Total	301			$\overline{X}_3 > \overline{X}_1$	$\overline{X}_3 > \overline{X}_2$

Eighth Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	107	21.33	22.91	22.53	Between	2	13.00	6.50	0.24	N.S.
2	107	20.62	21.93	22.10	Within	288	7674.65	26.65		
3	78	20.47	22.27	22.55	Total	290				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

The statistical analysis was done on the adjusted scores. An F-table (a table based on probability and found in most statistics textbooks) implies that an obtained F-ratio of 3.03 with 2 and 300 degrees of freedom would be significant at the .05 level of confidence. This implies that if our F-ratio would have been 3.03 or higher, we could have concluded that there was a significant difference somewhere between our adjusted posttest means. (Three possible places for significant differences--between 1 and 2, between 1 and 3, and between 2 and 3.) Please note that an F-ratio of 3.03 is at the 5% level of confidence--this implies that we are running a 5% chance of concluding that a significant difference exists when in fact it does not--the illusion could arise mainly from sampling error (let's say 4 or 5 of the "best" students were absent either pre or post) and from errors of measurement (test not really measuring what the children know).

For the present table, the obtained F-ratio was higher than the tabled value--5.44 compared to 3.03. The F-ratio of 5.44 certainly implies a significant difference somewhere between the adjusted posttest means--in fact, it is significant beyond the 1% level. In this case, the probability of saying a significant difference exists when in fact it does not is less than 1% ($p < .01$).

When an F-ratio implies a significant difference (always "Sig" under Decision), we need to apply additional tests to determine which pairs of means differ significantly. For Table 2, it was found that the adjusted mean for Group 3 ($\overline{X}_3$) was significantly larger than the adjusted means of group 2 as well as group 3.

There was not a difference between the means of groups 1 and 2. This finding is noted under the obtained F-ratio.

For the interested reader, the ex-post-facto tests (after a significant F) are those derived by Scheffé and tested at the .10 level.

If a table under the heading Decision should have "N.S.", this implies that a non-significant difference existed between the three adjusted means. An example of this is at the bottom of Table 2--the F-ratio of 0.24 implies that there was not a significant difference between the three eighth-grade means of 22.53, 22.10, and 22.55.

In summary, Table 2 implied that the seventh grade self-contained children had a significantly larger mean on the computational section of the Stanford Arithmetic test than did the other two groups of seventh graders. There was not a significant difference between the adjusted means of eighth grade sections.

Table 3 presents findings in a similar manner to Table 2; however, Table 3 refers to the concepts section of the Stanford Arithmetic Test. The top of Table 3 implies that there is a significant difference between the means of the various groups. It can be observed from Table 3 that the mean of the third group is significantly larger than the mean of the second group, also that the mean of the third group is significantly larger than the mean of the first group. Thus, it may be concluded that the mean of 21.74 was found to be significantly larger than the means of 19.11 and 19.33. A Significant difference was not found between 19.11

TABLE 3

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

Stanford Arithmetic -- Concepts

(pretest, September; posttest, May)

Seventh Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	106	14.09	19.26	19.33	Between	2	396	198.01	8.05	Sig.
2	110	14.17	19.11	19.11	Within	299	7356	24.60	$p < .01$	
3	87	14.29	21.83	21.74	Total	301			$\overline{X}_3 > \overline{X}_2$	$\overline{X}_3 > \overline{X}_1$

Eighth Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	107	19.36	22.13	21.87	Between	2	24.57	12.29	0.57	N.S.
2	107	18.47	21.91	22.39	Within	288	6211	21.57		
3	78	19.40	22.01	21.71	Total	290				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

and 19.33. The bottom section of Table 3 presents findings related to the eighth grade. As can be noted in that section of the table, the F-ratio of 0.57 implies that there were no significant differences between the adjusted posttest means for the eighth graders.

Table 4 presents basic data and the analusis of covariance summary table for the applications section of the Stanford Arithmetic Test for the two grade levels. The top part of Table 4 implies that a significant difference was found somewhere between the three adjusted posttest means. Ex-post-facto analyses implied that the mean of the third group was significantly larger than the mean of the second group. It was also found that the mean of the third group was significantly larger than the mean of the first group. Saying ir differently, no significant differences were found between groups 1 and 2, however, the mean of the third group was significantly larger than either mean of the other two groups. The bottom of Table 4 implies that there were no significant differences between the adjusted posttest means for the three groups of 8th graders. It might be concluded that each approach was equally effective for the 8th graders for this section of the Stanford Test.

Table 5 presents an analysis for the total scores of the Stanford Arithmetic Test. The total score is merely the sum of the computation section, the concept section, and the application section. The top part of Table 5 implies that there was a significant difference for the 7th grade groups. It was found by later analyses that the mean of the 3rd group was significantly larger than the

TABLE 4

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

Stanford Arithmetic -- Applications

(pretest, September; posttest, May)

Seventh Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	106	12.33	13.85	14.33	Between	2	154	77.24	5.32	Sig.
2	110	13.95	14.28	13.78	Within	299	4339	14.51	$p < .01$	
3	87	13.03	15.49	15.55	Total	301			$\overline{X}_3 > \overline{X}_2$	$\overline{X}_3 > \overline{X}_1$

Eighth Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	107	15.31	15.89	15.86	Between	2	4.22	2.11	0.12	N.S.
2	107	15.42	16.22	16.11	Within	288	5155	17.90		
3	78	14.99	15.90	16.09	Total	290				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

TABLE 5

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

Stanford Arithmetic -- Total

(pretest, September; posttest, May)

Seventh Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	106	39.48	50.39	51.85	Between	2	2438	1219.00	13.11	Sig.
2	110	42.50	51.06	49.80	Within	299	27793	92.95	$p < .001$	
3	87	41.31	56.97	56.78	Total	301			$\overline{X}_3 > \overline{X}_2$	$\overline{X}_3 > \overline{X}_1$

Eighth Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	107	55.99	60.93	60.14	Between	2	11.81	5.91	0.06	N.S.
2	107	54.50	60.06	60.60	Within	288	28712	99.70		
3	78	54.74	60.18	60.50	Total	290				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

mean of the 2nd group and also that the mean of the 3rd group was significantly larger than the mean of the 1st group. A significant difference was not found between the means of groups 1 and 2. The bottom part of Table 5 implies that no significant differences were to be found among the 3 means of the eighth grade.

B. Stanford Reading Test.

Table 6 presents the Basic Data and Analysis of Covariance Summary Table for grades 7 and 8 for the Stanford Reading Test. The top part of the table (for the 7th grade) presents an F-ratio of 0.63. This implies that there was not a significant difference between the three adjusted posttest means for the 7th grade. The bottom part of Table 6 presents an F-ratio of 0.09 for the eighth grade groups. This likewise was a non-significant F and it implies that there was not a significant difference between the adjusted posttest reading means for the 8th grade.

Data in this table may be interpreted to imply that the three approaches to teaching arithmetic affected reading in an equivalent manner. Saying it in a different way, the different approaches to teaching arithmetic did not seem to affect reading achievement.

C. Various Attitude Scales

Two basic attitude forms were given to the students in a pre/post fashion. Appendix 1 presents the attitude forms in question. The first attitude form consisted of 12 questions labeled a, b, c, d, e, f, g, h, i, j, k, l. The students' answers to question c, d, e,

TABLE 6

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

Stanford Reading Test

(pretest, September; posttest, May)

Seventh Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	107	24.81	31.81	32.69	Between	2	69.88	34.94	0.63	N.S.
2	110	25.95	33.75	33.80	Within	300	16681	55.60		
3	87	27.56	34.17	33.03	Total	302				

Eighth Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	108	34.73	38.61	38.38	Between	2	10.30	5.15	0.09	N.S.
2	107	33.74	37.59	38.03	Within	288	17264	59.95		
3	77	34.83	38.25	37.95	Total	290				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

and f were added together to give the students a total score for these four sections. Table 7 presents the Basic Data and Analysis of Covariance Summary Table for these Attitude Scores. It can be observed very quickly that no significant differences were found for the three groups of seventh graders and the three groups of 8th graders for these attitude scores.

Question "h" asked the students to respond to the question "working with Teaching machines is?" Table 8 presents the analyses of these scores. It may be observed in Table 8 that the 7th graders did not differ significantly on their answers to this question. In other words the means of groups 1, 2, and 3 are to be considered approximately equal; they do not differ significantly in any case. The bottom of Table 8 implies that the 8th graders answered this question differently. The F-ratio of 5.66 implies that there was a significantly difference somewhere between groups 1, 2, and 3. Later analyses found that the first mean or the mean of the first group as significantly larger than the mean of the second group and that the mean of the third group was significantly larger than the mean of the second group. (The higher the mean the more positive the score.) This implied that the didactor group did not appreciate working with teaching machines as much as the team teaching group or the self-contained group. It should be mentioned here, however, that groups 1 and 3 had very little experience working with machines. It is interesting to note that all means for the 8th grade are numerically smaller than the means for the 7th grade. The implication of this is not readily apparent. Perhaps it has

TABLE 7

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

Attitude Toward Arithmetic

Questions C + D + E + F (First Attitude Form)

Seventh Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	104	134.13	134.86	135.01	Between	2	301	150.59	0.33	N.S.
2	105	140.92	133.19	132.60	Within	291	131112	450.56		
3	86	130.60	133.19	133.73	Total	293				

Eighth Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	96	131.51	125.85	124.21	Between	2	981	490.78	1.37	N.S.
2	101	127.61	124.16	124 92	Within	264	94741	358.87		
3	71	126.99	127.72	128.86	Total	266				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

TABLE 8

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

Attitudes Toward Teaching Machines

Seventh Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	104	31.67	30.47	30.91	Between	2	121.29	60.64	1.10	N.S.
2	105	37.21	32.71	31.97	Within	291	15982.81	54.92		
3	86	32.01	29.97	30.33	Total	293				

Eighth Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	96	29.06	28.63	28.76	Between	2	732	365.98	5.66	Sig.
2	101	30.33	25.69	25.26	Within	264	17063	64.63	$p < .005$	
3	71	28.37	28.14	28.58	Total	266			$\overline{X}_1 > \overline{X}_2$	$\overline{X}_3 > \overline{X}_2$

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

to do with the age of the students. Perhaps machines are more appropriate for the younger student than they are for the older. However, before concluding that this is really so, additional data should be gathered and analyzed.

The last question on the attitude form, question 1 had to do with "what are your feelings concerning high school mathematics?" Table 9 presents basic data and the analyses of the students' scores to this question. The top part of Table 9 implies that the three groups of 7th graders did not answer the question significantly different from each other. The bottom part of the table shows that the 8th graders did not answer the question significantly different either. It may be concluded that as far as looking forward to taking high school mathematics courses, there is not a significant difference between the three approaches.

The last page in Appendix I presents another attitude form. In the field of arithmetic literature this form would be noted as the Dutton Attitude Test Toward Arithmetic. Table 10 presents the Basic Data and Analysis of Covariance Summary Table for the Dutton Arithmetic Attitude Test. The top part of Table 10 presents the findings related to 7th grade and as before the bottom part presents findings for the 8th grade. The F-ratios of 0.79 and 0.77 respectively imply that the 7th grade groups did not differ significantly with the responses on this attitude form and the 8th grade groups did not differ significantly with their answers to this form. It should be mentioned also that the 7th grade attitudes were somewhat higher than the 8th grade attitudes.

TABLE 9

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

Attitudes Toward Future Math Courses

Seventh Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	104	32.00	31.38	31.34	Between	2	130.22	65.11	1.35	N.S.
2	105	32.13	32.75	32.67	Within	291	14034	48.23		
3	86	31.50	32.65	32.80	Total	293				

Eighth Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	96	31.40	32.00	31.99	Between	2	16.18	8.09	0.20	N.S.
2	101	31.48	32.58	32.54	Within	264	10455	39.60		
3	71	31.15	32.34	32.42	Total	266				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

TABLE 10

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

Dutton Arithmetic Attitude Test

Seventh Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	104	85.57	84.66	84.66	Between	2	417.44	208.72	0.79	N.S.
2	105	84.64	85.61	85.96	Within	291	76684	263.52		
3	86	86.70	88.07	87.64	Total	293				

Eighth Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	96	83.54	82.92	82.56	Between	2	252	126.07	0.77	N.S.
2	101	82.52	81.74	82.06	Within	264	43131	163.38		
3	71	82.97	84.42	84.45	Total	266				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

D. Project Tests

A Project Test was devised and administered on two occasions. The first test was given in the month of January and the second and last test was given around May 1. The project test is presented in Appendix 2 and consists of three different booklets. The test was devised in much the same manner as the Stanford Arithmetic Test. Booklet A of the Project Test presented 30 questions related to Arithmetic Concepts, Booklet B presented 30 questions related to Arithmetic Computations, and Booklet C presented 20 questions related to Arithmetic Application.

Table 11 presents the Basic Data and Summary Table for Section A of the Project Test. This would be 30 questions dealing with Arithmetic Concepts. It can be noted from the top of Table 11 that there was a significant difference somewhere between the means of groups 1, 2, and 3, for the 7th grade. Later analyses implied that the mean of the third group was significantly larger than the mean of the second group. It was also found that the mean of the third group was significantly larger than the mean of the first group. The bottom part of Table 11 implies that no significant differences were found between and among the three groups of 8th graders.

Table 12, in a similar manner to Table 11, presents the Basic Data and Summary Table for Section B of the Project Test. This was 30 questions related to Arithmetic Computations. The top part of Table 12 implies that a significant difference did not exist between the three adjusted posttest means for the 7th grade.

TABLE 11

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

Section A -- Project Test

Criterion -- May test; Covariate -- January test

Seventh Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	106	15.29	16.90	17.59	Between	2	71.40	35.70	3.48	Sig.
2	104	16.65	17.96	17.59	Within	289	2968.45	10.27	$p < .05$	
3	83	16.72	19.11	18.69	Total	291			$\overline{X}_3 > \overline{X}_2$	$\overline{X}_3 > \overline{X}_1$

Eighth Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	103	17.45	18.51	18.85	Between	2	2.62	1.31	0.10	N.S.
2	102	17.71	18.88	19.00	Within	277	3530	12.74		
3	76	18.55	19.37	18.76	Total	279				

* 1--Team Teaching Approach   2--Didactor Approach   3--Self-Contained Approach

TABLE 12

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

Section B -- Project Test

Criterion -- May test; Covariate -- January test

Seventh Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	106	13.08	14.38	15.50	Between	2	71.65	35.82	2.98	N.S.
2	104	14.72	15.36	14.98	Within	289	3475.87	12.03		
3	83	15.37	17.19	16.23	Total	291				

Eighth Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	103	16.11	17.58	17.97	Between	2	153	76.67	6.20	Sig.
2	102	16.52	16.25	16.28	Within	277	3424	12.36	$p < .005$	
3	76	17.25	18.08	17.50	Total	279			$\overline{X}_1 > \overline{X}_2$	$\overline{X}_3 > \overline{X}_2$

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

The bottom part of Table 12 presents data which imply that significant mean differences existed somewhere between the three groups of 8th graders. Later analyses leads one to conclude that the mean of the first group was significantly larger than the mean of the second group. And that the mean of the third group was significantly larger than the mean of the second group. No significant differences were found between groups 1 and 3. It may be concluded that the means of Groups 1 and 3 were both significantly larger than the mean of group 2.

Table 13 presents the Basic Data and Summary Table for Section C of the Project Test. Section C consisted of 20 questions related to Arithmetic Application. It can be observed from the top of Table 13 that no significant differences existed between the adjusted posttest means for the 7th grade. The bottom part of Table 13 implies that a significant difference existed somewhere between the means of groups 1, 2, and 3 for the 8th graders. Later analyses implied that the mean of the first group was significantly larger than the mean of the third group. No other significant differences were to be found.

In a manner similar to the Stanford Tests, the scores from the three sections were added together to give a total project test score. Table 14 presents a Basic Data and Summary Table for these total Project Test Scores. It may be observed from the top part of Table 14 that the 7th graders differed significantly on their means for this test. A later analysis implied that the mean for the third group could be considered to be larger than the mean for the second group. No other significant finding could be found.

TABLE 13

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

Section C -- Project Test

Criterion -- May test; Covariate -- January test

Seventh Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	106	9.31	10.17	10.49	Between	2	3.36	1.68	0.25	N.S.
2	104	9.98	10.61	10.47	Within	289	1943.99	6.73		
3	83	10.10	10.94	10.72	Total	291				

Eighth Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	103	10.52	11.53	11.82	Between	2	68.36	34.18	3.91	Sig.
2	102	11.04	11.03	10.96	Within	277	2421	8.74		
3	76	11.36	10.95	10.65	Total	279			$\overline{X}_1 > \overline{X}_3$	

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

TABLE 14

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

Total Project Test

Criterion -- May test; Covariate -- January test

Seventh Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	106	37.68	41.44	43.84	Between	2	298	149.03	4.26	Sig.
2	104	41.36	43.93	42.92	Within	289	10101	34.95	$p < .05$	
3	83	42.19	47.24	45.45	Total	291			$\overline{X}_3 > \overline{X}_2$	

Eighth Grade

BASIC DATA					ANALYSIS OF COVARIANCE SUMMARY TABLE					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Decision
1	103	44.08	47.63	48.78	Between	2	367	183.77	3.57	Sig.
2	102	45.26	46.16	46.23	Within	277	14276	51.54		
3	76	47.16	48.39	46.74	Total	279			$\overline{X}_1 > \overline{X}_2$	$\overline{X}_1 > \overline{X}_3$

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

The bottom part of the table implies that there was a significant difference between the groups of 1, 2, and 3 for the 8th graders. A later analysis found that the mean of the first group was significantly larger than the mean of the second group and that the mean of the first group was significantly larger than the mean of the third group. There was not a significant difference between the means of groups 2 and 3.

E. Item Analysis For The Project Test

Presented on the next few pages are item analyses for the January as well as the May project tests. Group 81 refers to Approach No. 1 for the 8th grade. Group 82 refers to the second approach or the didactor approach for 8th grade mathematics. Group 83 refers to the self-contained approach. Group 71 refers to the team-teaching approach, Group 72 is the didactor approach, and Group 73 is the self-contained-one class approach. The answer to the item is doubly stated; for example, for the first item, A is the correct answer. It can be observed that 83% of the 81 group answered the question correctly in May. It would seem that the group that made the most progress for this item between January and May was the didactor approach for the 7th grade. Seventy-nine percent of the students answered the question correctly in January and 91% answered the question correctly in May. The rest of the questions can be analyzed in a similar manner. The data are more or less self-explanatory and the evaluator will not describe similar comparisons and interesting findings for each and every item. This type of data lends itself to more of a personal interpretation than say a covariance analysis.

ITEM ANALYSIS--PROJECT TESTS

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
1	81	83	2	10	2	2	86	2	7	4	1
(Place Value)	82	86	0	11	1	1	89	1	6	2	2
	83	80	1	17	1	0	88	2	7	2	0
	71	71	0	25	4	1	74	3	14	8	2
	72	79	2	13	3	2	91	1	8	0	0
	73	90	1	2	6	0	98	1	1	0	0

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B**	C	D	E	A	B**	C	D	E
2	81	5	77	3	6	6	1	88	2	6	3
	82	5	78	2	6	8	4	81	5	4	6
(Equality of	83	2	85	0	5	7	2	84	0	5	9
fractional	71	4	76	2	7	9	1	78	1	9	9
numbers)	72	4	82	4	5	5	5	83	2	7	4
	73	1	88	0	3	7	1	91	0	7	1

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D	E**	A	B	C	D	E**
3	81	16	36	3	5	39	13	37	3	5	42
	82	10	44	2	3	40	13	27	4	9	46
(Time)	83	12	42	1	2	42	4	38	1	2	54
	71	13	35	3	13	33	10	37	2	8	42
	72	10	41	3	4	42	7	37	5	6	45
	73	6	34	2	13	44	11	33	1	8	47

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C**	D	E	A	B	C**	D	E
4	81	1	3	81	5	8	0	3	79	11	6
	82	3	2	89	5	2	4	2	92	1	2
(Like Frac-	83	1	1	79	11	7	0	2	85	6	6
tions)	71	6	6	77	5	4	3	5	85	5	2
	72	3	3	81	7	7	0	5	85	6	5
	73	9	3	79	3	5	3	0	88	2	5

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D**	E	A	B	C	D**	E
5 (Recording Time)	81	3	5	8	83	1	1	3	8	82	3
	82	1	4	8	86	2	3	2	16	76	3
	83	2	6	10	79	2	1	9	10	79	1
	71	3	6	7	81	2	1	1	8	86	3
	72	1	4	8	87	1	2	6	6	85	0
	73	1	7	12	78	0	1	2	10	82	2

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
6 (Measurement)	81	50	5	6	18	21	58	3	6	9	22
	82	52	2	6	19	22	64	1	4	18	12
	83	54	4	7	16	19	49	5	5	17	23
	71	60	0	4	12	21	60	3	5	16	15
	72	55	0	6	17	23	58	2	6	19	13
	73	57	1	6	20	14	67	1	6	10	14

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B**	C	D	E	A	B**	C	D	E
7 Fractional number greater than one	81	6	70	11	5	6	4	79	7	5	5
	82	5	76	8	0	10	9	76	4	2	8
	83	5	73	6	9	0	11	81	4	1	2
	71	4	60	13	6	11	4	75	8	5	6
	72	5	71	8	3	12	6	74	6	4	10
	73	3	76	3	2	12	9	74	5	2	8

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
8 (Rounding Off)	81	87	1	7	3	1	82	5	10	1	1
	82	90	2	4	4	1	88	1	3	3	4
	83	81	2	9	4	2	84	4	7	2	2
	71	81	5	6	1	6	84	5	2	3	7
	72	82	2	8	4	4	89	3	3	3	1
	73	93	0	3	2	1	91	2	6	1	0

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		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D	E**	A	B	C	D	E**
9 (Measurement)	81	9	3	6	28	53	6	7	6	25	54
	82	5	3	7	18	65	8	5	6	11	68
	83	2	1	5	23	67	7	7	7	21	57
	71	7	3	10	28	50	7	2	7	25	59
	72	6	3	8	25	57	6	4	8	23	57
	73	13	2	5	20	59	14	5	7	10	64

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D**	E	A	B	C	D**	E
10 (Figures to Respresent Fractional Numbers)	81	5	7	5	61	18	1	9	6	69	14
	82	3	5	4	64	21	1	5	8	67	17
	83	6	5	11	69	9	6	9	6	70	9
	71	4	5	5	67	13	3	6	9	65	13
	72	5	8	8	60	18	3	11	5	67	14
	73	2	9	10	52	24	3	5	8	70	9

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
11 Words to Numberals	81	80	11	6	0	3	86	4	8	0	1
	82	84	5	8	2	1	82	4	8	4	2
	83	86	4	7	0	1	85	5	5	2	1
	71	72	13	12	2	2	80	5	11	2	3
	72	77	8	11	2	1	84	3	10	2	1
	73	85	7	7	0	1	84	6	6	2	1

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D**	E	A	B	C	D**	E
12 Precision in Measurement	81	2	12	6	74	5	2	14	5	73	5
	82	1	17	3	66	10	5	14	2	71	8
	83	6	20	7	59	7	2	16	6	69	6
	71	5	16	6	67	4	2	20	2	73	4
	72	3	20	2	63	12	4	18	3	72	4
	73	2	16	10	63	8	5	19	2	72	2

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		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B**	C	D	E	A	B**	C	D	E
13 Measurement to nearest 1/16th	81	3	60	10	5	22	3	72	8	4	10
	82	2	63	6	8	20	1	69	8	5	17
	83	1	65	14	5	15	6	62	9	7	16
	71	3	50	12	10	26	1	62	9	9	19
	72	4	62	8	7	17	3	71	6	6	15
	73	3	53	5	7	29	0	70	3	3	15

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B**	C	D	E	A	B**	C	D	E
14 Rounding-off	81	4	60	23	12	1	3	61	22	11	2
	82	11	58	16	13	1	11	63	14	8	2
	83	9	58	22	11	0	10	63	17	10	0
	71	12	42	26	17	1	5	45	31	18	1
	72	8	48	28	11	2	14	46	27	14	0
	73	7	53	23	16	0	10	51	27	9	0

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C**	D	E	A	B	C**	D	E
15 Comparison of Fractions to Percents	81	9	1	47	6	37	16	1	48	6	28
	82	9	3	51	3	33	8	7	55	3	26
	83	7	6	48	0	37	4	6	59	2	27
	71	9	4	41	3	43	6	0	49	5	38
	72	11	1	47	5	36	8	3	50	5	33
	73	9	0	42	5	44	11	1	53	2	32

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
16 Time	81	38	16	18	9	11	35	25	20	8	8
	82	28	19	25	8	11	31	23	25	7	11
	83	23	27	27	10	9	27	30	25	7	11
	71	36	26	19	3	10	36	25	17	7	9
	72	36	25	20	6	10	39	22	23	5	9
	73	26	29	22	7	12	35	22	19	7	9

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
17 Reading Numerals	81	81	4	4	5	7	85	1	8	2	2
	82	89	1	4	3	4	84	4	8	2	2
	83	78	2	10	1	9	80	4	5	2	9
	71	73	4	5	4	12	77	3	10	4	5
	72	82	5	8	2	2	83	4	7	4	3
	73	86	1	9	1	2	82	2	7	5	5

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C**	D	E	A	B	C**	L	E
18 Diagrams to Show Fractional Numbers	81	14	14	49	8	14	21	11	57	5	6
	82	8	15	58	7	12	9	9	66	8	6
	83	11	9	58	9	14	15	12	59	10	4
	71	20	16	46	9	6	21	9	51	9	7
	72	19	12	54	8	6	17	6	52	17	9
	73	13	16	52	6	12	13	9	68	3	6

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C**	D	E	A	B	C**	D	E
19 Diagrams to Show Fractional Numbers	81	6	7	46	21	19	5	5	60	24	6
	82	4	8	50	27	9	5	5	58	22	9
	83	4	11	43	26	16	11	10	53	15	11
	71	7	6	41	30	12	5	9	42	28	14
	72	6	5	42	37	10	4	3	52	31	10
	73	5	5	41	30	17	3	6	55	19	17

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D**	E	A	B	C	D**	E
20 Numerals to Words--Decimal Numerals	81	35	10	7	42	5	40	7	3	44	5
	82	34	10	3	50	2	25	10	9	49	5
	83	37	14	1	44	4	35	12	0	49	4
	71	30	13	10	42	4	32	11	10	43	5
	72	39	13	8	39	1	46	14	7	32	1
	73	34	16	16	33	1	42	5	5	49	0

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Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A	B	C	D**	E	A	B	C	D**	E
21 Largest Decimal Number	81	15	9	4	46	25	13	8	1	51	25
	82	13	13	3	51	19	8	9	2	60	19
	83	14	7	10	57	11	19	10	5	53	14
	71	6	21	6	35	27	16	13	5	41	24
	72	6	8	4	56	26	15	7	6	52	19
	73	8	14	9	40	27	10	10	5	51	22

Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A**	B	C	D	E	A**	B	C	D	E
22 Roman Numerals	81	20	5	14	12	36	19	4	10	23	37
	82	17	3	13	18	36	25	5	21	21	21
	83	42	7	21	9	16	41	9	25	11	14
	71	20	7	14	16	31	15	12	15	15	29
	72	20	6	8	21	35	36	6	10	14	30
	73	57	6	7	7	21	47	2	9	10	28

Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A	B	C**	D	E	A	B	C**	D	E
23 Place Value--Decimals	81	6	16	57	5	15	5	13	70	5	7
	82	5	6	65	5	17	4	8	64	11	12
	83	7	2	70	4	15	6	6	68	6	14
	71	12	12	50	8	18	8	10	58	8	15
	72	12	6	54	6	23	8	7	61	6	17
	73	9	6	49	6	29	8	3	69	3	15

Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A	B	C	D**	E	A	B	C	D**	E
24 Rounding Off Numbers	81	7	10	5	68	8	9	12	6	67	5
	82	8	13	9	65	3	10	14	4	71	0
	83	6	6	5	81	1	9	5	10	74	2
	71	12	12	10	53	12	10	15	10	54	11
	72	11	23	4	58	3	9	17	7	61	6
	73	14	13	2	66	3	14	9	6	60	9

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		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B**	C	D	E	A	B**	C	D	E
25 Rounding Off Numbers	81	11	59	17	7	6	11	51	24	2	9
	82	6	71	9	3	11	8	64	13	8	7
	83	14	59	10	5	12	9	65	11	6	9
	71	5	42	16	11	23	11	45	22	8	12
	72	12	45	23	5	12	9	56	18	7	7
	73	10	40	15	13	20	11	45	24	6	11

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C**	D	E	A	B	C**	D	E
26 Rounding Off Numbers	81	2	15	52	24	4	3	14	48	28	5
	82	2	18	37	34	5	3	17	54	25	0
	83	1	11	52	30	6	1	12	54	26	6
	71	2	15	47	18	14	3	15	51	16	14
	72	5	20	40	30	2	1	18	42	27	10
	73	3	13	45	30	6	2	19	43	22	9

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
27 Changing Decimals to Percents	81	57	20	13	7	3	63	11	13	8	3
	82	25	25	31	15	3	36	18	28	13	4
	83	84	6	9	1	0	74	9	9	9	0
	71	24	27	19	20	7	46	12	15	20	4
	72	23	29	34	11	3	33	31	28	5	1
	73	14	34	36	13	2	60	7	20	9	3

		January, 1972 Percent of Responses					May. 1972 Percent of Responses				
Item	Group*	A	B**	C	D	E	A	B**	C	D	E
28 Ratio	81	4	46	16	14	13	8	60	14	13	3
	82	9	53	15	8	8	11	63	9	11	4
	83	5	49	23	9	7	6	63	15	9	7
	71	13	40	18	17	9	10	50	15	12	11
	72	10	47	22	7	11	6	57	17	12	6
	73	3	55	21	9	8	6	63	18	5	6

ITEM ANALYSIS--PROJECT TEST

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D**	E	A	B	C	D**	E
29 Concepts of Parts of Circle	81	14	31	7	35	5	20	22	6	47	4
	82	18	30	8	29	9	27	30	7	25	2
	83	20	41	6	27	1	16	30	6	44	4
	71	23	30	7	20	12	21	25	7	32	8
	72	17	38	5	31	5	15	37	7	30	8
	73	19	26	8	28	10	15	35	9	33	5

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
30 Comparing decimals to fractional numbers	81	41	20	15	4	21	38	17	21	5	19
	82	47	15	16	3	19	49	10	14	9	14
	83	48	21	14	1	14	47	10	20	5	19
	71	35	22	10	4	27	43	21	15	4	17
	72	39	15	22	5	20	41	28	15	5	10
	73	35	14	14	1	35	42	14	20	7	17

COMPUTATIONS

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D	E**	A	B	C	D	E**
31 Multiplication Whole Numbers	81	4	4	2	2	88	1	1	3	0	95
	82	4	2	4	1	86	0	7	5	2	86
	83	2	4	4	9	80	2	4	5	1	86
	71	2	1	7	3	87	0	6	5	2	86
	72	0	2	7	2	88	4	4	2	1	90
	73	0	2	8	6	81	3	1	2	5	85

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B**	C	D	E	A	B**	C	D	E
32 Arranging Fractional Numbers	81	4	65	4	18	9	4	81	1	11	3
	82	3	77	5	15	0	6	75	3	13	2
	83	4	73	5	17	0	6	81	5	6	1
	71	4	58	2	27	8	6	57	2	27	7
	72	4	73	0	22	1	2	82	2	12	3
	73	3	47	1	36	13	2	64	1	26	7

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		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C**	D	E	A	B	C**	D	E
33 Equivalent Fractions	81	9	23	50	3	14	10	17	54	3	13
	82	7	17	55	4	17	7	16	48	5	21
	83	6	14	48	0	32	5	25	49	7	14
	71	10	12	50	7	19	5	15	48	4	25
	72	13	25	36	3	21	16	17	44	6	14
	73	12	20	43	3	20	8	15	53	3	17

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D	E**	A	B	C	D	E**
34 Division-- Whole Numbers	81	5	4	6	1	84	6	3	3	0	88
	82	6	1	6	2	85	6	2	8	6	77
	83	7	4	7	4	77	2	0	2	2	93
	71	5	2	7	4	81	4	5	7	0	85
	72	8	3	7	3	80	10	3	8	4	74
	73	6	5	5	2	81	3	1	8	5	83

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B**	C	D	E	A	B**	C	D	E
35 Subtraction-- Fractional Numbers	81	3	74	6	1	15	3	80	3	0	13
	82	3	77	2	1	15	6	75	6	2	9
	83	9	69	7	1	12	2	78	6	2	11
	71	7	55	7	3	23	5	67	6	3	19
	72	9	74	7	0	10	5	73	7	2	13
	73	3	80	5	0	10	5	82	1	1	10

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
36 Equivalent Fractions	81	63	10	8	5	6	73	4	8	5	9
	82	71	6	8	7	4	75	5	8	4	3
	83	75	10	6	4	5	75	7	5	2	9
	71	67	10	6	6	5	66	3	7	8	12
	72	69	8	13	3	5	75	6	6	6	6
	73	76	3	3	3	12	77	6	6	3	8

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Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A	B	C	D**	E	A	B	C	D**	E
37	81	4	3	33	25	30	1	5	41	23	28
Perimeter of Figures	82	5	2	37	23	26	6	7	25	30	27
	83	2	2	36	19	38	4	6	17	47	26
	71	3	3	21	30	31	4	5	23	28	37
	72	4	6	21	29	30	2	4	26	26	41
	73	1	2	24	24	40	3	6	20	48	19

Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A**	B	C	D	E	A**	B	C	D	E
38	81	56	6	4	13	19	52	3	8	21	17
Multiplication Whole Numbers	82	48	14	6	7	20	49	6	6	15	21
	83	56	6	5	17	14	59	9	5	9	17
	71	38	4	5	10	37	39	5	5	19	32
	72	44	13	6	12	20	41	9	7	18	23
	73	58	6	6	6	20	53	9	6	7	23

Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A	B	C**	D	E	A	B	C**	D	E
39	81	3	2	75	4	17	3	4	81	3	9
Multiplication Whole Number Times a Decimal	82	1	5	83	1	10	4	6	77	4	8
	83	2	2	83	4	7	2	6	79	4	9
	71	4	4	62	3	19	5	7	63	6	18
	72	1	3	80	1	14	3	6	72	3	17
	73	3	7	64	1	17	0	7	73	2	17

Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A	B	C**	D	E	A	B	C**	D	E
40	81	6	3	71	4	13	4	6	75	4	10
Addition--Decimals	82	4	2	86	4	4	4	6	80	6	4
	83	9	4	78	4	5	4	2	78	6	10
	71	4	2	63	5	15	5	4	67	8	12
	72	4	7	67	6	12	3	5	79	4	9
	73	1	1	80	3	12	3	3	78	5	9

ITEM ANALYSIS--PROJECT TEST

Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A**	B	C	D	E	A**	B	C	D	E
41 Subtraction Whole Numbers	81	83	5	2	0	11	97	1	0	1	1
	82	91	4	0	0	6	82	5	3	2	8
	83	90	1	1	4	4	83	7	4	1	4
	71	82	5	3	1	9	81	5	5	0	10
	72	86	3	3	1	8	78	10	2	2	8
	73	88	1	1	1	8	88	2	1	0	7

Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A	B**	C	D	E	A	B**	C	D	E
42 Decimal Division	81	8	57	12	5	16	12	71	8	4	6
	82	12	65	9	5	4	18	58	9	6	6
	83	5	72	9	2	11	15	57	9	9	11
	71	26	33	7	10	16	14	48	10	6	20
	72	9	58	5	14	9	9	51	8	14	17
	73	24	45	8	7	9	7	68	3	5	16

Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A	B	C**	D	E	A	B	C**	D	E
43 Multiplication of Fractional Numbers	81	1	2	76	4	15	0	4	80	6	9
	82	0	2	80	4	12	1	8	77	5	8
	83	1	2	84	4	9	1	1	78	4	16
	71	0	11	62	6	19	4	5	59	7	21
	72	2	3	75	8	12	4	7	64	6	18
	73	2	5	76	1	16	3	3	78	2	11

Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A	B	C**	D	E	A	B	C**	D	E
44 Division of Whole Numbers	81	12	3	58	4	23	9	8	65	7	10
	82	11	7	66	3	8	8	9	64	7	8
	83	7	5	68	6	12	11	11	64	4	10
	71	16	2	62	4	14	9	8	60	5	17
	72	17	8	53	5	13	11	7	63	6	13
	73	5	6	76	5	8	5	7	69	3	11

ITEM ANALYSIS--PROJECT TEST

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C**	D	E	A	B	C**	D	E
45 Fraction to A Decimal	81	18	7	49	2	18	19	4	60	1	15
	82	25	8	33	3	28	28	10	35	8	17
	83	12	7	52	2	22	11	7	58	2	21
	71	22	8	17	2	39	20	7	33	5	27
	72	17	8	22	4	37	24	11	26	4	33
	73	33	3	13	0	43	14	6	60	5	16

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D	E**	A	B	C	D	E**
46 Percent to a Fraction	81	17	5	8	9	55	25	3	1	10	61
	82	23	8	3	14	46	26	5	7	12	48
	83	12	5	7	7	64	9	4	11	10	67
	71	17	8	8	13	35	21	6	2	12	51
	72	9	12	8	5	55	14	10	6	9	61
	73	19	5	8	5	53	19	6	8	8	51

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D	E**	A	B	C	D	E**
47 Area & Division of Whole Numbers	81	29	8	5	5	50	25	5	13	8	47
	82	27	5	10	13	39	28	8	4	8	49
	83	23	10	5	10	52	26	9	6	10	48
	71	34	4	5	12	42	25	6	10	7	49
	72	36	8	4	6	44	32	4	10	8	45
	73	22	5	3	17	50	24	8	5	6	55

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B**	C	D	E	A	B**	C	D	E
48 Division of Fractional Numbers	81	1	59	16	14	9	2	69	13	7	8
	82	3	61	16	11	5	5	68	14	4	7
	83	2	69	12	6	10	1	73	9	11	6
	71	3	34	27	14	14	3	45	23	8	16
	72	2	54	25	5	10	4	51	13	11	18
	73	0	74	7	2	14	1	64	9	8	16

ITEM ANALYSIS--PROJECT TEST

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D	E**	A	B	C	D	E**
49	81	23	7	6	2	61	18	8	5	3	66
Addition of Fractional Numbers	82	19	12	4	2	61	19	15	8	1	54
	83	10	15	4	4	65	9	17	10	0	63
	71	39	14	3	4	38	26	13	4	5	51
	72	26	15	8	0	50	22	12	5	5	56
	73	19	13	1	0	66	15	7	5	6	68

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
50	81	41	27	26	5	1	46	19	23	8	5
Multiplication of Fractional Numbers	82	43	25	18	8	4	53	22	15	7	1
	83	36	23	30	7	4	41	16	22	14	6
	71	28	41	22	8	1	34	31	22	6	5
	72	31	28	24	13	4	44	29	18	6	2
	73	34	20	36	5	6	39	26	26	7	2

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
51	81	27	14	7	10	38	34	10	7	7	39
Diagram & Percents	82	32	22	9	3	28	23	25	8	7	32
	83	30	11	10	9	30	31	15	7	11	33
	71	12	8	11	8	44	18	14	11	5	41
	72	17	12	11	4	42	20	11	17	10	38
	73	19	9	7	2	53	44	5	9	7	30

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D	E**	A	B	C	D	E**
52	81	24	6	14	14	34	35	8	8	9	38
Area	82	42	5	7	13	27	31	8	14	12	32
	83	28	9	7	14	33	40	5	10	6	37
	71	46	4	12	12	18	43	6	12	7	26
	72	42	4	12	10	23	44	6	11	15	24
	73	44	8	8	12	22	50	3	11	15	15

ITEM ANALYSIS--PROJECT TEST

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D	E**	A	B	C	D	E**
53	81	14	10	5	13	50	8	10	11	15	48
Fractions to Decimals	82	8	10	24	4	43	8	14	22	17	35
	83	4	5	10	5	72	2	16	7	16	57
	71	11	12	17	5	38	5	12	11	8	54
	72	11	10	13	7	41	11	14	19	17	37
	73	16	8	10	5	45	6	10	7	16	56

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D	E**	A	B	C	D	E**
54	81	19	32	13	7	27	22	25	10	8	35
Arranging Fractions	82	25	22	12	8	31	20	27	14	8	28
	83	16	20	9	15	38	17	12	14	11	44
	71	19	28	15	8	29	10	27	20	10	31
	72	27	29	13	8	21	27	21	12	8	31
	73	13	38	10	8	28	10	27	13	9	40

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D**	E	A	B	C	D**	E
55	81	22	5	8	52	9	28	8	4	48	12
Decimal Division	82	25	9	5	53	6	27	9	8	43	8
	83	17	10	4	58	7	21	4	15	52	7
	71	30	9	7	31	13	24	13	7	39	11
	72	19	6	10	51	7	23	8	5	52	11
	73	27	17	2	30	16	22	9	9	49	9

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
56	81	36	12	13	7	29	35	16	24	3	21
Equations	82	40	7	16	5	30	40	11	23	7	16
	83	40	12	12	4	30	42	15	21	6	15
	71	33	21	14	5	26	33	6	19	8	31
	72	30	13	12	10	30	36	17	11	9	26
	73	28	9	21	6	35	34	16	18	10	19

ITEM ANALYSIS--PROJECT TEST

Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A	B	C	D**	E	A	B	C	D**	E
57 Addition of Signed Numbers	81	1	5	27	61	5	3	4	30	54	9
	82	2	3	29	62	3	2	4	27	61	4
	83	1	2	19	65	12	6	5	25	57	6
	71	1	3	35	53	7	3	4	35	54	3
	72	2	3	36	52	8	1	3	29	60	5
	73	3	1	30	62	2	0	1	20	65	9

Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A**	B	C	D	E	A**	B	C	D	E
58 Area of Circle	81	18	14	17	14	11	32	8	20	23	13
	82	19	14	9	17	7	19	12	20	23	8
	83	21	9	17	20	6	38	15	16	19	9
	71	13	14	12	24	6	15	17	22	19	9
	72	12	11	20	12	8	11	16	21	28	11
	73	14	9	16	23	10	19	15	22	15	10

Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A	B	C	D	E**	A	B	C	D	E**
59 Percents to Fractions	81	6	9	38	12	32	4	5	41	12	37
	82	2	5	42	12	39	3	6	38	13	39
	83	6	7	58	7	20	2	7	46	15	27
	71	3	8	36	20	27	6	5	42	15	28
	72	2	4	45	15	29	1	6	46	14	31
	73	6	3	35	17	37	3	8	49	6	32

Item	Group*	January, 1972 Percent of Responses					May, 1972 Percent of Responses				
		A**	B	C	D	E	A**	B	C	D	E
60 Equality of Fractions	81	35	19	21	10	14	35	14	29	11	9
	82	52	14	16	7	8	46	11	22	14	5
	83	42	12	21	10	14	40	21	17	9	11
	71	33	14	21	15	13	29	19	24	13	14
	72	30	25	18	10	12	33	17	26	11	13
	73	34	19	16	15	13	33	14	25	9	16

ITEM ANALYSIS--PROJECT TEST

APPLICATIONS
(Word Problems)

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B**	C	D	E	A	B**	C	D	E
61 Division & then Multiplication of Decimal Numbers	81	11	75	5	3	6	7	82	4	0	8
	82	7	81	4	1	7	8	80	2	0	9
	83	6	77	6	0	10	7	75	9	1	7
	71	12	65	6	1	14	8	79	2	0	11
	72	6	80	4	1	9	4	82	2	0	13
	73	0	87	3	0	9	3	83	2	0	11

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
62 Addition & Then Subtraction of Decimal Numbers	81	67	3	5	0	26	75	3	5	5	13
	82	78	3	2	4	13	70	5	4	3	18
	83	78	4	5	2	11	72	7	1	5	15
	71	63	4	3	4	26	72	7	3	1	17
	72	79	0	6	2	13	73	2	4	5	17
	73	69	1	5	3	22	70	2	2	10	15

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C**	D	E	A	B	C**	D	E
63 Multiplication of Fraction & Whole Number	81	19	16	43	6	12	12	13	56	5	12
	82	22	10	47	8	6	19	16	50	6	5
	83	11	9	52	11	10	19	9	51	9	11
	71	19	15	39	7	11	16	13	50	5	12
	72	20	18	44	7	8	19	14	52	7	6
	73	16	12	42	12	12	20	8	53	3	8

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D**	E	A	B	C	D**	E
64 Percentage	81	21	5	6	41	24	25	5	3	45	22
	82	13	7	4	47	21	22	6	6	42	16
	83	14	2	4	58	20	23	9	6	46	15
	71	9	8	4	45	26	19	4	6	41	23
	72	23	6	3	39	25	21	7	2	42	23
	73	17	9	3	44	17	16	7	5	47	20

ITEM ANALYSIS--PROJECT TEST

Item	Group*	January, 1972 Percent of Responses A	B	C	D**	E	May, 1972 Percent of Responses A	B	C	D**	E
65 Addition & then Division of Decimals	81	10	6	14	64	5	8	3	19	60	9
	82	8	6	13	59	11	10	6	16	57	11
	83	4	11	20	53	11	12	10	12	60	5
	71	4	7	14	59	15	5	9	22	54	11
	72	3	8	21	58	9	7	6	26	55	6
	73	9	7	20	53	10	3	2	26	52	13

Item	Group*	January, 1972 Percent of Responses A	B	C**	D	E	May, 1972 Percent of Responses A	B	C**	D	E
66 Division & then Subtraction of Decimals	81	9	22	35	6	26	8	19	45	5	24
	82	9	29	44	1	12	6	16	51	6	21
	83	10	21	46	5	16	7	15	52	6	17
	71	8	26	28	5	24	5	25	31	6	32
	72	14	26	30	3	24	10	28	32	4	24
	73	12	23	33	6	22	6	28	32	6	25

Item	Group*	January, 1972 Percent of Responses A	B**	C	D	E	May, 1972 Percent of Responses A	B**	C	D	E
67 Decimal Division	81	3	81	6	4	6	7	79	5	1	8
	82	10	69	7	2	8	10	71	8	4	4
	83	10	73	10	1	5	5	73	9	2	10
	71	7	78	4	3	5	5	73	5	5	10
	72	4	75	8	5	8	8	79	5	6	1
	73	2	81	5	2	8	5	69	8	5	14

Item	Group*	January, 1972 Percent of Responses A	B	C**	D	E	May, 1972 Percent of Responses A	B	C**	D	E
68 Addition of Whole Numbers	81	6	3	72	9	8	5	6	80	1	8
	82	6	1	72	9	10	3	10	71	8	8
	83	2	6	73	6	11	4	7	75	7	6
	71	3	4	76	4	12	5	2	83	2	7
	72	0	7	75	7	10	2	5	83	3	7
	73	1	6	73	3	15	1	3	84	1	7

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C	D	E**	A	B	C	D	E**
69 Multiplication & then Addition of Decimals	81	13	8	14	3	62	15	9	18	3	62
	82	13	9	10	6	61	17	8	8	4	64
	83	15	10	5	6	63	12	10	19	4	56
	71	12	12	13	3	61	17	10	7	3	63
	72	14	17	10	2	57	14	13	8	1	63
	73	19	12	6	5	58	14	8	7	3	65

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C**	D	E	A	B	C**	D	E
70 Subtraction & then Division of Decimals	81	5	4	86	3	3	3	8	88	0	1
	82	3	7	87	1	3	2	10	85	1	2
	83	2	2	91	1	2	5	10	75	6	4
	71	3	4	82	3	8	6	6	81	1	5
	72	4	9	83	2	1	5	5	86	2	3
	73	6	6	83	1	5	1	10	85	0	3

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
71 Decimal Division	81	67	7	9	5	10	71	9	6	8	7
	82	72	6	3	10	7	59	15	8	10	6
	83	62	6	15	7	7	52	15	14	5	14
	71	57	12	8	13	5	69	6	7	5	12
	72	60	11	12	5	7	67	6	9	8	9
	73	62	7	7	6	13	66	7	2	8	11

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C**	D	E	A	B	C**	D	E
72 Subtraction & then Division of Decimals	81	3	8	79	7	3	3	12	74	8	4
	82	1	13	76	7	3	7	7	64	15	4
	83	6	11	73	6	4	5	10	69	12	4
	71	4	12	64	12	5	4	12	72	8	4
	72	8	12	65	9	3	6	15	72	6	1
	73	50	13	14	6	15	0	9	78	8	3

ITEM ANALYSIS--PROJECT TEST

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
73 Addition & then Subtraction of Decimals	81	57	11	8	9	15	70	5	8	8	10
	82	66	7	3	8	15	63	7	8	7	15
	83	56	6	11	9	19	60	15	9	4	12
	71	60	6	6	6	18	58	8	9	5	19
	72	57	10	6	9	17	62	7	11	5	15
	73	50	13	14	6	15	64	5	9	5	17

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
74 Subtraction of Fractional Number	81	44	14	20	5	16	57	13	16	2	11
	82	50	25	14	1	8	54	11	22	5	8
	83	60	10	15	2	12	54	14	12	7	12
	71	34	34	16	4	9	41	15	27	0	15
	72	40	20	22	6	11	46	8	30	3	13
	73	52	12	22	1	12	50	16	20	3	9

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B**	C	D	E	A	B**	C	D	E
75 Multiplication then Division, then Multiplication--fraction & Whole Number	81	13	40	17	14	14	10	51	13	14	10
	82	16	44	16	15	5	10	51	23	12	3
	83	15	47	9	20	7	7	48	19	15	10
	71	15	25	19	24	10	17	38	17	15	8
	72	17	30	20	18	11	19	31	20	16	14
	73	17	31	19	14	12	14	48	11	10	10

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B**	C	D	E	A	B**	C	D	E
76 Addition & then Multi. (Whole Numbers & Fractions)	81	10	18	13	11	43	17	25	13	6	31
	82	23	14	19	11	23	16	26	18	17	17
	83	20	19	17	2	33	22	17	10	15	30
	71	9	16	14	14	35	12	15	15	14	41
	72	15	22	11	8	31	13	21	21	14	27
	73	16	16	12	12	34	16	23	16	8	31

ITEM ANALYSIS--PROJECT TEST

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C**	D	E	A	B	C**	D	E
77	81	7	17	40	5	23	9	20	42	3	24
Multiplication of Fractions	82	6	25	42	2	13	5	26	43	6	13
	83	6	27	43	7	6	6	16	46	10	19
	71	7	29	22	7	23	8	26	32	11	15
	72	8	24	25	8	22	4	25	39	8	20
	73	12	13	37	8	22	3	23	34	10	23

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
78	81	30	19	8	15	19	31	27	6	16	16
Percentage	82	25	21	8	16	14	27	31	8	16	14
	83	40	14	7	21	11	38	19	14	14	14
	71	18	30	11	12	16	18	30	12	10	25
	72	23	24	5	9	23	23	28	11	14	17
	73	16	22	9	15	26	32	15	10	15	22

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A**	B	C	D	E	A**	B	C	D	E
79	81	14	19	17	23	18	24	28	13	18	12
Percentage	82	24	21	12	16	11	25	30	16	14	5
	83	14	21	23	15	15	23	31	22	10	6
	71	19	12	22	13	17	21	15	17	21	17
	72	15	17	23	11	13	18	20	22	19	16
	73	8	13	24	13	21	23	11	11	20	24

		January, 1972 Percent of Responses					May, 1972 Percent of Responses				
Item	Group*	A	B	C**	D	E	A	B	C**	D	E
80	81	17	14	45	5	17	23	18	39	6	13
Average of Measurements	82	19	11	52	7	8	24	16	42	5	10
	83	16	10	48	6	19	23	12	42	5	17
	71	22	19	29	4	19	24	17	29	6	22
	72	19	18	42	3	13	22	19	37	7	13
	73	17	9	37	7	26	16	17	40	2	20

3. ANALYSES (ANCOVA) BY I.Q. LEVELS FOR GRADES 7 & 8

A. Stanford Arithmetic Test

As mentioned before, all students were recently given intelligence tests. For the purposes of this study, those students in both grades 7 and 8 with I.Q.'s of 89 or less were classified as low I.Q. students. Students with I.Q.'s between 90 and 109 were classified as average I.Q. students. Those students with I.Q.'s of 110 and above were classified as having high I.Q.'s. The following tables present analyses by these differing I.Q. levels for the Stanford Arithmetic Test as well as for the Project Test. As before, the covariate in each case was the appropriate pre-test. The following scheme is utilized: if the table is labeled A it is for the 7th grade and if the table is labeled B it is for the 8th grade.

Table 15A presents Basic Data and the Summary Tables for the 7th grade low I.Q. students, the average I.Q. students, and the high I.Q. students for the computation section of the Stanford Arithmetic Test. The top part of Table 15A implies that the three groups--Method 1, low I.Q. students; Method 2, low I.Q. students; and Method 3, low I.Q. students did not differ significantly on the mean computation scores for the Stanford Arithmetic Test. The middle section of Table 15A presents a significant F-ratio of 3.92; this significant F-ratio implies that somewhere between the means of 17.92, 16.30, and 16.51 there is at least one significant difference. Later analyses found that the mean of the third group was larger than the mean of the second group and also that the mean of the third group was larger than the mean of the first group. In other words, the self-contained

TABLE 15A

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

BY I. Q. LEVELS

Stanford Arithmetic Test--Computations

Seventh Grade: Low I.Q.'s (89 or less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Low	13	10.08	11.31	11.07	Bet.	2	10.64	5.32		
2 Low	8	9.25	11.50	11.70	W-in	28	258.32	9.23	0.58	N.S.
3 Low	11	9.36	12.27	12.41	Total	30				

Seventh Grade Average I.Q.'s (90-109)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Aver	67	14.49	16.03	16.51	Bet.	2	79.12	39.56		
2 Aver	67	15.60	16.58	16.30	W-in	176	1775	10.09	3.92	Sig. $p < .025$
3 Aver	46	15.63	18.22	17.92	Total	178			$\overline{X}_3 > \overline{X}_2$	$\overline{X}_3 > \overline{X}_1$

Seventh Grade High I.Q.'s (110 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 High	24	21.00	22.79	22.96	Bet.	2	1.86	.93		
2 High	29	21.14	22.93	23.02	W-in	75	619	8.26	0.11	N.S.
3 High	26	21.77	23.58	23.32	Total	77				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

classroom mean was larger than the mean of the didactor approach as well as the mean of the team-teaching approach.

The bottom section of Table 15A implies that there were no significant differences among the three means of the high I.Q. students.

Table 15B presents similar findings for the computation section of the Stanford Arithmetic Test by I.Q. levels for the 8th graders. It can be concluded quickly by glancing at the table that no significant differences were found for any of the I.Q. levels.

Table 16A presents Basic Data and Summary Tables for the seventh grade I.Q. levels for the concepts section of the Stanford Arithmetic Test. No significant differences were found among the three adjusted posttest means for the low I.Q. students.

The middle of Table 16A presents a significant F-ratio. It was later found that the mean of the third group 15.39 was significantly larger than the mean of the second group, a mean of 13.53. No other significant differences were found. The bottom section of the table presents a non-significant F-ratio which implies that there were no significant differences between the 7th grade high I.Q. students on the concepts section of the Stanford Arithmetic Test.

Table 16B presents similar findings to Table 16A for the 8th grade. The top part of Table 16B presents a non-significant F-ratio which implies that the three groups of 8th grade students did not differ significantly on the adjusted posttest means for the concepts section of the Stanford Arithmetic Test. The middle part of the table presents a significant F-ratio of 3.22. It was later found that $\overline{X}_1$ (the mean of the first group) could be considered to be larger than the mean of the second group. No other significant pair-

TABLE 15B

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By I. Q. Levels--Stanford Arithmetic Test--Computations

Eighth Grade Low I.Q.'s (89 or less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Low	10	10.40	11.90	12.43	Bet.	2	39	19.52		
2 Low	11	11.00	14.55	14.32	W-in	24	601	25.06	0.78	N.S.
3 Low	7	11.14	11.86	11.45	Total	26				

Eighth Grade Average I.Q.'s (90-109)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Aver	54	15.63	16.37	16.72	Bet.	2	4.6	2.31		
2 Aver	58	16.00	17.05	17.10	W-in	153	2125	13.89	0.17	N.S.
3 Aver	45	16.67	17.53	17.05	Total	155				

Eighth Grade High I. Q.'s (110 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 High	38	21.89	23.34	24.00	Bet.	2	5.07	2.54		
2 High	32	23.16	23.72	23.60	W-in	89	570	6.41	0.39	N.S.
3 High	23	24.43	25.09	24.18	Total	91				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

TABLE 16A

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By I. Q. Levels

Stanford Arithmetic Test--Concepts

Seventh Grade Low I. Q.'s (89 or less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Low	13	8.85	8.62	8.64	Bet.	2	3.44	1.72		
2 Low	8	7.13	8.00	9.37	W-in	28	321	11.47	0.15	N.S.
3 Low	11	10.18	10.27	9.25	Total	30				

Seventh Grade Average I. Q.'s (90-109)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Aver	67	12.28	13.39	14.03	Bet.	2	96.91	48.45		
2 Aver	67	13.57	13.88	13.53	W-in	176	2082	11.84	4.09	Sig.
3 Aver	46	13.65	15.80	15.39	Total	178			$\overline{X}_3 > \overline{X}_2$	

Seventh Grade High I. Q.'s (110 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 High	24	17.96	20.71	21.78	Bet.	2	18.29	9.14		
2 High	29	19.48	20.79	20.73	W-in	75	691	9.23	0.99	N.S.
3 High	26	20.62	22.58	21.66	Total	77				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

TABLE 16B

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

BY I. Q. LEVELS

Stanford Arithmetic Test--Concepts

Eighth Grade Low I. Q.'s (89 or less)

Basic Data					Analysis of Covariance Summary Table					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Dec.
1 Low	10	7.50	10.90	12.48	Bet.	2	35.76	17.88		
2 Low	11	10.91	10.45	9.71	W-in	24	345.95	14.41	1.24	N.S.
3 Low	7	11.43	12.14	11.04	Total	26				

Eighth Grade Average I. Q.'s (90-109)

Basic Data					Analysis of Covariance Summary Table					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Dec.
1 Aver	54	14.17	15.65	16.06	Bet.	2	84	42.03	3.22	Sig.
2 Aver	58	14.83	14.43	14.35	W-in	153	1998	13.06		$p < .05$
3 Aver	45	15.24	15.87	15.48	Total	155				$\overline{X}_1 > \overline{X}_2$

Eighth Grade High I. Q.'s (110 and above)

Basic Data					Analysis of Covariance Summary Table					
Group*	N	Obtained Means Pre	Obtained Means Post	Adj. Posttest Means	Source	df	SS	MS	F	Dec.
1 High	38	20.87	21.84	22.46	Bet.	2	33.32	16.66		
2 High	32	21.63	21.69	21.68	W-in	89	862	9.69	1.72	N.S.
3 High	23	22.83	24.26	23.25	Total	91				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

wise differences were found. The bottom section of Table 16B presents another non-significant F-ratio; this would imply that no significant mean differences were to be found between the high I.Q. students for the 8th grade on the concepts section of the Stanford Arithmetic Test.

Table 17A presents, as did the preceeding tables, basic data and summary tables for the Applications Section of the Stanford Arithmetic Test. The first part of the table shows that there was a significant F-ratio for the 7th grade low I.Q. students. It was later found that the mean of the second group (7.80) could well be considered to be larger than the mean of the third group, 5.07. No other significant differences were found. It should be mentioned that this is about the first time that the second group was found to be significantly higher than either of the other two groups. The bottom two parts of the table present two non-significant F-ratios. These would imply that the average I.Q. students did not differ significantly on the applications section nor did the high I.Q. students differ significantly.

Table 17B presents Basic Data and Summary Tables for the 8th grade students on the Stanford Arithmetic Test--Applications. It can quickly be concluded by glancing at the table that no significant differences were found for any of the comparisons.

Table 18A presents Basic Data and Summary Tables for the Total Scores on the Stanford Arithmetic Test for the Various I.Q. levels for the 7th grade. The top part of 18A implies that no significant differences were found between the three adjusted posttest means for the low I.Q. students for the Total Scores. The middle section of Table 18A implies that there was a significant difference somewhere between the adjusted posttest means. This was implied by a signifi-

TABLE 17A

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By I. Q. Levels

Stanford Arithmetic Test--Applications

Seventh Grade Low I. Q.'s (89 or less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Dec.
1 Low	13	6.69	7.23	7.22	Bet.	2	42.20	21.10	4.37	Sig.
2 Low	8	6.50	7.75	7.80	W-in	28	135.25	4.83		$p < .025$
3 Low	11	6.73	5.09	5.07	Total	30				$\overline{X}_2 > \overline{X}_3$

Seventh Grade Average I. Q.'s (90-109)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Dec.
1 Aver	67	8.72	9.78	9.95	Bet.	2	14.78	7.39		
2 Aver	67	9.19	9.82	9.74	W-in	176	1069	6.07	1.22	N.S.
3 Aver	46	9.30	10.61	10.47	Total	178				

Seventh Grade High I. Q.'s (110 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Dec.
1 High	24	12.67	12.92	12.98	Bet.	2	11.80	5.90		
2 High	29	12.76	13.24	13.26	W-in	75	451	6.01	0.98	N.S.
3 High	26	12.92	14.00	13.92	Total	77				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

TABLE 17B

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By I. Q. Levels

Stanford Arithmetic Test--Applications

Eighth Grade Low I. Q.'s (89 or less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Low	10	6.40	7.40	7.64	Bet.	2	35.89	17.95		
2 Low	11	6.36	7.45	7.72	W-in	24	205	8.55	2.10	N.S.
3 Low	7	8.14	5.71	4.96	Total	26				

Eighth Grade Average I. Q.'s (90-109)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Aver	54	9.44	10.37	10.66	Bet.	2	29.9	14.95		
2 Aver	58	10.59	9.91	9.63	W-in	153	1338	8.74	1.71	N.S.
3 Aver	45	10.00	9.93	9.95	Total	155				

Eighth Grade High I. Q.'s (110 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 High	38	13.16	14.11	14.41	Bet.	2	4.22	2.11		
2 High	32	13.44	14.16	14.30	W-in	89	528	5.94	0.36	N.S.
3 High	23	14.87	14.57	13.87	Total	91				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

TABLE 18A

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By I. Q. Levels

Stanford Arithmetic Test--Total

Seventh Grade Low I. Q.'s (89 or less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Dec.
1 Low	13	25.62	27.15	26.78	Bet.	2	31.72	15.86		
2 Low	8	22.88	27.25	29.11	W-in	28	765	27.32	0.58	N.S.
3 Low	11	26.27	27.64	26.73	Total	30				

Seventh Grade Average I. Q.'s (90-109)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Dec.
1 Aver	67	35.49	39.19	40.79	Bet.	2	474	236.91	6.79	Sig.
2 Aver	67	38.36	40.28	39.42	W-in	176	6137	34.87	$p < .005$	
3 Aver	46	38.59	44.63	43.57	Total	178			$\overline{X}_3 > \overline{X}_2$	$\overline{X}_3 > \overline{X}_1$

Seventh Grade High I. Q.'s (110 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Dec.
1 High	24	52.50	56.79	57.34	Bet.	2	48.59	24.30		
2 High	29	51.93	55.69	56.67	W-in	75	2101	28.01	0.87	N.S.
3 High	26	55.31	60.15	58.56	Total	77				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

cant F-ratio of 6.79. Later analyses found that the mean of the third group was larger than the mean of the second group and that the mean of the third group was larger than the mean of the first group. The bottom part of Table 18A presents a non-significant F-ratio of 0.87; this implies no significant differences between the three adjusted posttest means for the high I.Q. students.

Table 18B presents findings similar to Table 18A but for the 8th grade. It can quickly be determined from glancing at Table 18B that no significant differences were to be found between the adjusted posttest means for any of the various classifications.

B. Project Test

Rather than looking at each section of the Project Test in a manner similar to the Stanford Arithmetic Tests, only the total scores were used. Table 19A presents the findings pertaining to the various I.Q. levels for the 7th grade on Project Test Totals. The first part of the table implies that no significant differences were to be found between the three groups for the low I.Q. levels. This was implied by a non-significant F-ratio of 0.94. The middle section of the table presents a significant F-ratio of 8.97. This implies that significant differences can be found somewhere between the three adjusted posttest means. Later analyses found that the mean of the third group to be larger that the mean of the second group and also the mean of the third group to be larger than the mean of the first group. The bottom section of the table presents another significant F-ratio. Later analyses found that the mean of the third group could be considered to be larger than the mean of the second group. No other significant pair-wise differences were found.

TABLE 18B

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By I. Q. Levels

Stanford Arithmetic Test--Total

Eighth Grade Low I. Q.'s (89 and less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Low	10	24.30	30.20	33.91	Bet.	2	245	122.63		
2 Low	11	28.27	32.45	31.51	W-in	24	1706	71.09	1.73	N.S.
3 Low	7	30.71	29.71	25.91	Total	26				

Eighth Grade Average I. Q.'s (90-109)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Aver	54	39.24	42.39	43.67	Bet.	2	214	107.18		
2 Aver	58	41.41	41.40	40.90	W-in	153	9253	60.47	1.77	N.S.
3 Aver	45	41.91	43.33	42.43	Total	155				

Eighth Grade High I. Q.'s (110 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 High	38	56.16	59.66	61.50	Bet.	2	57.84	28.92		
2 High	32	58.22	59.56	59.67	W-in	89	2489	27.98	1.03	N.S.
3 High	23	62.13	63.91	60.73	Total	91				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

TABLE 19A

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By I. Q. Levels

Project Test--Total

Seventh Grade Low I. Q.'s (89 or less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Low	13	28.38	29.15	38.54	Bet.	2	172	86.33		
2 Low	8	25.88	32.00	32.91	W-in	28	2582	92.24	0.94	N.S.
3 Low	11	27.27	37.91	37.97	Total	30				

Seventh Grade Average I. Q.'s (90-109)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Aver	67	36.78	47.06	47.13	Bet.	2	1648	824.38	8.97	Sig.
2 Aver	67	37.93	46.79	45.96	W-in	176	16169	91.87	$p < .001$	
3 Aver	46	35.46	52.30	53.41	Total	178			$\overline{X}_3 > \overline{X}_2$	$\overline{X}_3 > \overline{X}_1$

Seventh Grade High I. Q.'s (110 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 High	24	54.67	67.58	68.34	Bet.	2	978	489.01	6.32	Sig.
2 High	29	54.62	63.34	64.14	W-in	75	5801	77.35	$p < .005$	
3 High	26	57.69	74.19	72.61	Total	77			$\overline{X}_3 > \overline{X}_2$	

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

Table 19B presents findings similar to Table 19A but for the 8th grade. It can be determined by quickly glancing at Table 19B that no significant differences were found within the various I.Q. levels for the 8th grade students on the total scores for the Project Test.

TABLE 19B

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By I. Q. Levels

Project Test--Total

Eighth Grade Low I. Q.'s (89 and less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Low	10	33.90	39.60	40.71	Bet.	2	88	44.09		
2 Low	11	36.00	42.73	41.85	W-in	24	3238	134.91	0.33	N.S.
3 Low	7	35.29	37.57	37.37	Total	26				

Eighth Grade Average I. Q.'s (90-109)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Aver	54	48.83	54.50	54.14	Bet.	2	6.06	3.03		
2 Aver	58	48.05	53.47	53.69	W-in	153	16565	108.27	0.03	N.S.
3 Aver	45	48.18	53.89	54.02	Total	155				

Eighth Grade High I. Q.'s (110 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 High	38	73.16	77.21	76.96	Bet.	2	118.18	59.09		
2 High	32	71.15	77.13	78.58	W-in	89	6037	67.83	0.87	N.S.
3 High	23	74.74	81.35	79.75	Total	91				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

4. ANALYSES (ANCOVA) BY READING LEVELS FOR GRADES 7 & 8

A. Stanford Arithmetic Test

The Stanford Reading Test was administered to all students at the beginning of the year. For the purposes of arriving at reading levels, scores of 19 and less were classified as low scores and the students receiving those scores were classified as low readers. Average readers were classified as having scored 20-39 on the Stanford Reading Test, and high readers were classified as those who had scored 40 and above.

It can be observed from the top of Table 20A that the low readers' means did not differ significantly for the Stanford Arithmetic Test Totals. The middle section of the table implies a significant F-ratio. It was later found that the mean of the third group, that would be the average readers of Approach No. 3, scored significantly higher than the average readers in Group No. 2. The bottom section of Table 20A implies that no significant mean differences existed for the high readers for the seventh grade.

Table 20B presents findings similar to Table 20A but for the 8th graders. It can be observed from examining Table 20B that no significant differences were found among the adjusted posttest means for the varying reading level students of the various approaches. All three F-ratios were listed as being non-significant.

B. Project Test

Table 21A presents Basic Data and Analysis of Covariance Summary Tables for the varying reading levels for the Total Scores for the Project Test. The top part of Table 21A presents a significant F-ratio of 3.19. Later analyses found that the mean of the third group

TABLE 20A

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By Reading Levels -- Stanford Arithmetic Test -- Total

Seventh Grade Low Readers (19 and less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Low	32	33.16	34.81	35.27	Bet.	2	154	77.07		
2 Low	32	35.56	36.84	35.11	W-in	81	3111	38.42	2.01	N.S.
3 Low	21	31.52	36.38	38.33	Total	83				

Seventh Grade Average Readers (20-39)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Aver	62	36.90	41.69	45.24	Bet.	2	214.55	107.28		
2 Aver	61	42.18	44.87	43.63	W-in	169	5600.90	33.14	3.24	Sig.
3 Aver	50	43.98	49.26	46.38	Total	171			$\overline{X}_3 > \overline{X}_2$	$p < .05$

Seventh Grade High Readers (40 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 High	10	60.10	63.40	60.34	Bet.	2	18.69	9.35		
2 High	11	53.64	59.36	61.36	W-in	28	556	19.86	0.47	N.S.
3 High	11	55.18	58.73	59.51	Total	30				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

TABLE 20B

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By Reading Levels -- Stanford Arithmetic Test -- Total

Eighth Grade Low Readers (19 and less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest Means						
Group*	N	Pre	Post		Source	df	SS	MS	F	Dec.
1 Low	8	32.25	38.63	40.21	Bet.	2	251	125.92		
2 Low	14	33.64	33.07	33.28	W-in	23	1043	45.39	2.77	N.S.
3 Low	5	37.00	37.40	34.29	Total	25				

Eighth Grade Average Readers (20-39)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest Means						
Group*	N	Pre	Post		Source	df	SS	MS	F	Dec.
1 Aver	54	39.81	42.72	43.29	Bet.	2	72.65	36.32		
2 Aver	55	40.87	42.11	41.72	W-in	148	8794	59.44	0.61	N.S.
3 Aver	43	40.67	42.28	42.07	Total	150				

Eighth Grade High Readers (40 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest Means						
Group*	N	Pre	Post		Source	df	SS	MS	F	Dec.
1 High	40	52.20	56.05	59.07	Bet.	2	62.86	31.43		
2 High	32	58.03	58.91	57.26	W-in	95	3926	41.34	0.76	N.S.
3 High	27	59.11	60.11	57.60	Total	97				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

TABLE 21A

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By Reading Levels -- Project Test Total

Seventh Grade Low Readers (19 and less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Low	32	34.38	42.63	40.63	Bet.	2	744	372.20		
2 Low	32	32.41	42.63	42.35	W-in	81	9458.73	116.77	3.19	Sig.
3 Low	21	28.14	44.86	48.32	Total	83			$p \leq .05$	
									$\bar{X}_3 > \bar{X}_1$	

Seventh Grade Average Readers (20-39)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Aver	62	38.48	50.10	52.74	Bet.	2	1343	671.59		
2 Aver	61	43.48	51.64	50.13	W-in	169	13363	79.07	8.49	Sig.
3 Aver	50	43.40	58.54	57.10	Total	171			$p \leq .001$	
									$\bar{X}_3 > \bar{X}_2$	$\bar{X}_3 > \bar{X}_1$

Seventh Grade High Readers (40 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 High	10	63.10	79.00	77.59	Bet.	2	472	236.16		
2 High	11	63.00	71.27	69.94	W-in	28	2593	92.63	2.55	N.S.
3 High	11	58.00	75.82	78.43	Total	30				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

could be considered to be larger than the mean of the first group. No other significant pair-wise differences were found. The middle section of the table implies another significant F-ratio. Later analyses found that the mean of the third group was larger than the mean of the second group and that the mean of the third group was larger than the mean of the first group. There was not a significant difference between the mean of the first group and the mean of the second group. The bottom section of Table 21A presents a non-significant F-ratio. This implies that no significant mean differences existed between the three adjusted posttest means for the high readers in the three approaches at the 7th grade level.

Table 21B is analogous to Table 21A but for the 8th grade. It can quickly be determined that no significant differences existed among the three approaches within the varying reading levels. All three F-ratios were insignificant.

TABLE 21B

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By Reading Levels -- Project Test Total

Eighth Grade Low Readers (19 and less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Low	8	36.63	40.13	41.23	Bet.	2	30.05	15.03		
2 Low	14	38.00	43.21	43.41	W-in	23	2341	101.82	0.15	N.S.
3 Low	5	41.80	46.20	43.88	Total	25				

Eighth Grade Average Readers (20-39)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Aver	54	50.30	55.83	54.22	Bet.	2	2.32	1.16		
2 Aver	55	48.11	53.91	54.07	W-in	148	15204	102.74	0.01	N.S.
3 Aver	43	46.07	52.56	54.38	Total	150				

Eighth Grade High Readers (40 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 High	40	68.68	73.43	74.95	Bet.	2	39.25	19.62	0.21	N.S.
2 High	32	71.31	77.16	76.39	W-in	95	8966	94.39		
3 High	27	72.00	76.59	75.23	Total	97				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

5. ANALYSIS (ANCOVA) BY SOCIAL ECONOMIC STANDING FOR GRADES 7 & 8

A. Stanford Arithmetic Test

The school personnel of the Galion School System applied the Warner Index of Father's Occupations to most of the students in the experiment. A copy of the guidelines can be found in Appendix 3 of this report. Students whose father's occupations were labeled as 1 or 2 from the Warner's Scale were classified as low SES students. Students whose father's occupations rated a 3, 4, or 5 from the Warner's Scale were rated as average SES students. High SES students were classified as having father's whose occupations rated 6 or 7 on the Warner's Scale. Table 22A presents Basic Data and Analysis of Covariance Summary Tables for the three levels of SES students on the Stanford Arithmetic Test Totals. The top part of the table presents a non-significant F-ratio of 0.95. This implies that no significant differences were to be found between the three adjusted posttest means for the low SES students among the three teaching approaches for the 7th grade. The middle section of the table presents another non-significant F-ratio. This implies that the average SES students did not differ significantly on the Stanford Arithmetic Totals. The bottom section presents another non-significant F-ratio. This implies that the high SES students did not differ on the adjusted posttest means.

Table 22B presents findings similar to Table 22A but for the 8th grade. The top section of Table 22B presents a non-significant F-ratio; this implies that the low SES students' means did not differ significantly among the three approaches. The middle section presents a significant F-ratio of 3.47. It was later found that the mean of the first group, a mean of 49.32 could be considered to be

TABLE 22A

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By Social-Economic-Standing

Stanford Arithmetic Test -- Total

Seventh Grade Low S.E.S. (1 & 2 on Warner's Scale)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Low	23	33.96	38.26	40.53	Bet.	2	62.92	31.46		
2 Low	27	39.67	42.59	39.38	W-in	62	2043	32.96	0.95	N.S.
3 Low	16	34.06	39.75	41.91	Total	64				

Seventh Grade Average S.E.S. (3, 4, & 5 on Warner's Scale)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Aver	57	39.61	42.79	44.62	Bet.	2	178	89.06		
2 Aver	55	42.22	44.18	43.63	W-in	155	5856	37.79	2.36	N.S.
3 Aver	47	43.34	47.85	46.27	Total	157				

Seventh Grade High S.E.S. (6 & 7 on Warner's Scale)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 High	19	40.84	45.05	48.36	Bet.	2	4.52	2.26		
2 High	18	44.17	48.44	48.60	W-in	48	1684	35.10	0.06	N.S.
3 High	15	48.93	53.47	49.10	Total	50				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

TABLE 22B

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By Social-Economic-Standing

Stanford Arithmetic Test -- Total

Eighth Grade Low S.E.S. (1 & 2 on Warner's Scale)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Low	26	38.27	41.92	44.59	Bet.	2	78.77	39.38		
2 Low	33	41.61	43.42	42.92	W-in	77	4542	58.99	0.67	N.S.
3 Low	22	43.59	47.59	45.20	Total	79				

Eighth Grade Average S.E.S. (3, 4 & 5 on Warner's Scale)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Aver	51	43.31	47.39	49.32	Bet.	2	408	204.40		
2 Aver	52	46.37	46.63	45.79	W-in	142	8368	58.93	3.47	Sig.
3 Aver	43	46.84	47.05	45.78	Total	144			$p < .05$	
									$\overline{X}_1 > \overline{X}_2$	$\overline{X}_1 > \overline{X}_3$

Eighth Grade High S.E.S. (6 & 7 on Warner's Scale)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 High	21	52.86	54.38	54.76	Bet.	2	12.13	6.06		
2 High	11	54.64	56.36	55.14	W-in	36	903	25.10	0.24	N.S.
3 High	8	52.50	52.88	53.57	Total	38				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

larger than the mean of the second group and that the mean of the first group could be considered to be larger than the mean of the third group. No other significant pair-wise mean differences were found. In other words, the average SES students in Approach No. 1 scored better than the average SES students in Approach No. 2 as well as the average SES students in Approach No. 3.

The bottom section of the table presents a non-significant F-ratio of 0.24. No significant differences were found between the adjusted posttest means for the high SES students between the three approaches to teaching 8th grade mathematics.

B. Project Test

In a manner similar to the Stanford Test, the various levels of the SES students were analyzed on the Project Test Totals. It can be observed from the top of Table 23A that the 7th grade low SES students did not differ significantly on the Project Test Totals. The middle section of the table implies a significant F-ratio of 5.83. It was later found that the mean of the third group could be considered to be larger than the mean of the first group and that the mean of the third group could well be considered to be larger than the mean of the second group- The bottom section of Table 23A presents another significant F-ratio. It was later found that the mean of the third group was larger than the mean of the second group. In other words the high SES students in Approach No. 3 had a mean significantly higher than the high SES students in Approach No. 2, the didactor approach. No other significant pair-wise differences were found.

Table 23B presents findings similar to Table 23A but for the 8th grade. It may be determined by quickly glancing at the data presented

TABLE 23A

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By Social-Economic-Standing

Project Test -- Total

Seventh Grade Low S.E.S.

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Low	23	35.83	46.39	46.81	Bet.	2	443	221.85		
2 Low	27	39.04	49.19	46.58	W-in	62	7455	120.24	1.85	N.S.
3 Low	16	32.25	49.06	52.85	Total	64				

Seventh Grade Average S.E.S.

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Aver	57	41.12	52.67	53.42	Bet.	2	1101	550.72		
2 Aver	55	42.18	51.76	51.59	W-in	155	14649	94.51	5.83	Sig.
3 Aver	47	42.79	58.74	58.04	Total	157			$p < .005$	
									$\overline{X}_3 > \overline{X}_1$	$\overline{X}_3 > \overline{X}_2$

Seventh Grade High S.E.S.

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 High	19	41.74	53.32	57.50	Bet.	2	754	377.38		
2 High	18	49.50	55.11	52.22	W-in	48	3608	75.17	5.02	Sig.
3 High	15	48.33	63.60	61.77	Total	50			$p < .01$	
									$\overline{X}_3 > \overline{X}_2$	

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

TABLE 23B

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By Social-Economic Standing

Project Test -- Total

Eighth Grade Low S.E.S.

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Low	26	47.23	50.62	52.38	Bet.	2	343	171.73		
2 Low	33	49.58	57.18	56.77	W-in	77	10804	140.32	1.22	N.S.
3 Low	22	50.73	58.32	56.84	Total	79				

Eighth Grade Average S.E.S.

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Aver	51	56.27	62.71	61.67	Bet.	2	176	88.24		
2 Aver	52	54.54	59.33	59.77	W-in	142	12458	87.73	1.01	N.S.
3 Aver	43	54.23	58.35	59.05	Total	144				

Eighth Grade High S.E.S.

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 High	21	67.24	71.05	69.91	Bet.	2	200.69	100.34		
2 High	11	65.54	73.09	73.37	W-in	36	2243	62.32	1.61	N.S.
3 High	8	62.75	72.75	75.35	Total	38				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

in 23B that no significant differences were found among the three adjusted posttest means for the low SES students, no significant differences for the average SES students, nor for the high SES students.

6. ANALYSIS (ANCOVA) FOR ATTITUDE LEVELS FOR GRADES 7 & 8

A. Stanford Arithmetic Test

All students were given the Dutton Arithmetic Attitude Test in September. The students were classified into three levels by their scores on this attitude test. Students who scored 79 and less were classified as having a low attitude toward arithmetic. Students who scored between 80 and 90 were classified as having an average attitude toward arithmetic and students scoring 91 and above were classified as having a high attitude toward arithmetic. Table 24A presents Basic Data and Analysis of Covariance Summary Tables for the various attitude levels on the Stanford Arithmetic Test Totals. It may be quickly concluded from observing Table 24A that no significant differences were found between the three approaches at each attitude level for these mean scores. All three F-ratios were insignificant.

Table 24B presents findings similar to 24A but for the 8th grade. It can be determined that one significant F-ratio was presented in 24B. This was at the top of the table, an F-ratio of 5.78. The F-ratio of 5.78 implied that there were significant differences somewhere between the three adjusted posttest means. Later analyses found that the mean of the first group could be considered to be larger than the mean of the second group and that the mean of the first group could be considered to be larger than the mean of the third group.

The middle section and the bottom section of Table 24B present two non-significant F-ratios.

Table 25A presents findings similar to Table 24A and Table 24B but for the Project Test Total Scores. It can be observed by glancing at the top of the table that the three groups did not differ on

TABLE 24A

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By Attitude Levels (Dutton Pretest)

Stanford Arithmetic Test -- Total

Seventh Grade Low Attitudes (79 and less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Dec.
1 Low	37	33.86	36.41	38.34	Bet.	2	175.91	87.96		
2 Low	46	38.57	40.11	37.61	W-in	103	3212	31.19	2.82	N.S.
3 Low	24	34.00	39.13	40.94	Total	105				

Seventh Grade Average Attitudes (80-99)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Dec.
1 Aver	48	37.79	42.40	45.16	Bet.	2	101	50.92		
2 Aver	39	40.36	43.59	44.08	W-in	125	4867	38.94	1.31	N.S.
3 Aver	42	44.98	49.95	46.34	Total	127				

Seventh Grade High Attitudes (100 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Dec.
1 High	19	46.47	50.05	51.47	Bet.	2	9.88	4.94		
2 High	18	49.89	53.72	51.96	W-in	49	1556	31.77	0.16	N.S.
3 High	16	47.69	52.25	52.54	Total	51				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

TABLE 24B

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By Attitude Levels (Dutton Pretest)

Stanford Arithmetic Test -- Total

Eighth Grade Low Attitudes (79 and less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Low	35	37.63	41.94	42.27	Bet.	2	461	230.59		
2 Low	37	36.97	36.57	37.48	W-in	103	4105	39.86	5.78	Sig.
3 Low	35	39.43	39.66	38.36	Total	105			$p < .005$	
									$\bar{X}_1 > \bar{X}_2$	$\bar{X}_1 > \bar{X}_3$

Eighth Grade Average Attitudes (80-99)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 Aver	44	43.82	47.59	50.44	Bet.	2	111	55.87		
2 Aver	51	47.80	48.88	48.40	W-in	122	7855	64.39	0.87	N.S.
3 Aver	31	51.10	53.35	50.12	Total	124				

Eighth Grade High Attitudes (100 and up)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest						
Group*	N	Pre	Post	Means	Source	df	SS	MS	F	Dec.
1 High	23	55.52	57.00	58.86	Bet.	2	67.66	33.83		
2 High	13	59.23	62.92	61.56	W-in	40	1519	37.99	0.89	N.S.
3 High	8	61.25	64.13	61.00	Total	42				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

TABLE 25A

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By Attitude Levels (Dutton Pretest)

Project Test -- Total

Seventh Grade Low Attitudes (79 and less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Dec.
1 Low	37	35.11	45.70	46.62	Bet.	2	206	103.46		
2 Low	46	38.04	46.52	45.04	W-in	103	9085	88.21	1.17	N.S.
3 Low	24	34.50	47.25	48.67	Total	105				

Seventh Grade Average Attitudes (80-99)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Dec.
1 Aver	48	38.63	49.75	51.90	Bet.	2	1528	764.45		
2 Aver	39	41.95	50.46	49.62	W-in	125	12740	101.92	7.50	Sig.
3 Aver	42	42.88	59.64	57.97	Total	127			$p < .001$	
									$\bar{X}_3 > \bar{X}_2$	$\bar{X}_3 > \bar{X}_1$

Seventh Grade High Attitudes (100 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means								
Group*	N	Pre	Post	Adj. Posttest Means	Source	df	SS	MS	F	Dec.
1 High	19	50.74	62.16	61.81	Bet.	2	554	277.06		
2 High	18	51.89	62.28	60.94	W-in	49	4015	81.94	3.38	Sig.
3 High	16	48.13	66.50	68.41	Total	51			$p < .05$	
									$\bar{X}_3 > \bar{X}_2$	$\bar{X}_3 > \bar{X}_1$

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

the Project Test Totals for the low attitudes. The middle section of the table implies that the three groups differed somewhere. It was later found that the mean of the third group could be considered to be larger than the mean of the second group and that the mean of the third group could be considered to be larger than the mean of the first group. At the bottom of Table 25A is another significant F-ratio. This F-ratio was later found to imply that the mean of the third group could be considered to be larger than the mean of the second group and that the mean of the third group could well be considered to be larger than the mean of the first group. No other significant pair-wise differences could be found. In other words, the high attitude students in Group No. 3 had a higher mean than the high attitude students in Method 2 as well as the high attitude students in Method 1.

Table 25B presents findings similar to 25A but for the 8th grade. It can be quickly determined that no significant F-ratios were obtained for any of the analyses here.

TABLE 25B

BASIC DATA AND ANALYSIS OF COVARIANCE SUMMARY TABLE

By Attitude Levels (Dutton Pretest)

Project Test -- Total

Eighth Grade Low Attitudes (79 and less)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest Means						
Group*	N	Pre	Post		Source	df	SS	MS	F	Dec.
1 Low	35	48.86	51.69	48.89	Bet.	2	135	67.77		
2 Low	37	43.76	47.73	49.11	W-in	103	12198	118.43	.57	N.S.
3 Low	35	43.80	50.06	51.40	Total	105				

Eighth Grade Average Attitudes (80-99)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest Means						
Group*	N	Pre	Post		Source	df	SS	MS	F	Dec.
1 Aver	44	55.88	62.14	63.12	Bet.	2	105	52.50		
2 Aver	51	55.35	63.14	64.55	W-in	122	11340	92.95	0.57	N.S.
3 Aver	31	61.65	66.03	62.31	Total	124				

Eighth Grade High Attitudes (100 and above)

Basic Data					Analysis of Covariance Summary Table					
		Obtained Means		Adj. Posttest Means						
Group*	N	Pre	Post		Source	df	SS	MS	F	Dec.
1 High	23	70.35	76.65	79.37	Bet.	2	165.66	82.83		
2 High	13	78.31	81.00	76.09	W-in	40	1983	49.59	1.67	N.S.
3 High	8	73.00	81.50	81.67	Total	42				

* 1--Team Teaching Approach 2--Didactor Approach 3--Self-Contained Approach

7. STATUS OF THE STUDENTS' GRADE EQUIVALENTS AT BEGINNING AND END OF 1971-72 SCHOOL YEAR IN ARITHMETIC AND READING

Table 26 presents, among other things, the grade equivalents for the mean whole-group raw scores for the various Stanford Tests. It can be observed from the left-half of the table that the actual grade placement for September 15 through October 15 was 7.1 for the 7th grade and 8.1 for the 8th. The right-half of the table implies that actual grade placement for the posttest was 7.8 and 8.8 respectively. A class mean would be average if its earned grade equivalent was equal to the actual grade placement. With this as a frame of reference, the following observations are a few of many that the table offers:

a. The 7th grade group appeared to come to the 7th grade approximately one year behind on arithmetic computations--these gained more than one year during the 7th grade but ended the year still below norm.

b. The eighth grade group had a mean gain of only .3 year in 8 months for computations.

c. Both grade levels did extremely well on arithmetic concepts--both grades ended the year above norms.

d. The 7th graders ended the year above norm for applications (8.1 compared to 7.8) -- the 8th graders ended the year below norm (8.5 compared to 8.8).

e. Averaging all math tests, the 7th graders were above norm at the end of the year (8.0 compared to 7.8) and the eighth graders slightly below norm (8.7 compared to 8.8).

f. Both grade levels appear to be above norms for reading.

Table 26

Grade Equivalents for the Various Students on the Stanford Arithmetic and Reading Tests

(Based on Whole Groups Means)

	September			May		
Test and Group	Raw Mean	Actual Grade Placement	Earned Grade Equivalent	Raw Mean	Actual Grade Placement	Earned Grade Equivalent
Math Computations						
71	13.06			17.27		
72	14.38			17.67		
73	13.99			19.64		
Average	13.81	7.1	6.2	18.19	7.8	7.3
81	21.33			22.91		
82	20.62			21.93		
83	20.47			22.27		
Average	20.81	8.1	8.0	22.37	8.8	8.3
Concepts						
71	14.09			19.26		
72	14.17			19.11		
73	14.29			21.83		
Average	14.18	7.1	6.7	20.07	7.8	8.5
81	19.36			22.13		
82	18.47			21.91		
83	19.40			22.01		
Average	19.08	8.1	7.8	22.02	8.8	9.2
Applications						
71	12.33			13.85		
72	13.95			14.28		
73	13.03			15.49		
Average	13.10	7.1	7.4	14.54	7.8	8.1
81	15.31			15.89		
82	15.42			16.22		
83	14.99			15.90		
Average	15.24	8.1	8.0	16.00	8.8	8.5
Total Arithmetic - grade 7 -			6.8			8.0
Total Arithmetic - grade 8 -			7.9			8.7
Reading						
71	24.81			31.81		
72	25.95			33.75		
73	27.56			34.17		
Average	26.11	7.1	6.5	33.24	7.8	7.85
81	34.73			38.61		
82	33.74			37.59		
83	34.83			38.25		
Average	34.43	8.1	8.1	38.15	8.8	8.9

8. Summary of the findings

As implied before, the major findings of the study are based on the 1971 - 1972 seventh graders and on their achievement as noted by the Stanford Arithmetic Test. The evaluators will attempt, when possible, to draw similarities between the Stanford results and the project test results.

The following list of findings is deemed appropriate:

A. For entire class analyses

1. Arithmetic computations -- mean of the self-contained classes significantly higher than the means of the team teaching and didactor approaches (Table 2). Same general trend present in Table 12 -- Section B of the project test.
2. Arithmetic concepts -- mean of the self-contained classes significantly higher than the means of the team teaching and didactor approaches (Table 3). Same finding for the project test (Table 11).
3. Arithmetic applications -- mean of the self-contained classes significantly higher than the means of the team teaching and didactor approaches (Table 4). Table 13 for the project test did not show a trend nor significance.
4. For total arithmetic -- mean of the self-contained classes significantly higher than the means of the team teaching and didactor approaches (Table 5). Same trends and partial findings are present in Table 14 for the project test.
5. Reading -- no significant differences between the means of the three approaches (Table 6).
6. Pupil attitudes toward arithmetic -- no significant differences between the means of the three approaches (Tables 7, 9, and 10).

7. Pupil attitudes toward teaching machines -- no significant differences between the means of the three approaches at the seventh grade level -- didactor students at the eighth grade level thought significantly less of machines than did the other two groups (Table 8).

B. For specific blocks of students

1. I.Q. blocks

    a. Average I.Q.'s -- computations

    The mean of the self-contained approach was significantly higher than the means of the other two approaches (Table 15A).

    b. Average I.Q.'s -- concepts

    The mean of the self-contained approach was significantly higher than the mean of the didactor approach (Table 16A).

    c. Low I.Q.'s -- applications

    The mean of the didactor approach was significantly higher than the mean of the self-contained approach (Table 17A).

    d. Average I.Q.'s -- total arithmetic

    The mean of the self-contained approach was significantly higher than the means of the other two approaches (Table 15A). This finding verified for total project test (Table 19A).

2. Reading blocks

    a. Average readers

    The mean of the self-contained approach was significantly higher than the mean of the didactor approach (Table 20A). For project test, the mean of the self-contained group was significantly higher than the means of the other two groups (Table 21A).

3. Socio - Economic blocks
    a. No reliable trend of one method being superior to any other for the Stanford Arithmetic Test.
4. Attitude levels
    a. No reliable trend of one method being superior to any other for the Stanford Arithmetic Test.

CHAPTER 4

COST-BENEFIT ANALYSIS OF THE GALION PROJECT

Introduction

The task implied in a cost-benefit analysis is to specify all costs and benefits, thereby deriving a set of decision-making alternatives. This concept of cost-benefit analysis appears deceptively simple, however the actual task of preparing a definitive analysis of costs and benefits tends to be complex. Suffice it to add that the complexity of the task is enhanced when it becomes necessary to compute costs from a traditional accounting system and assign benefits based on tested achievement.

The main requirement of a cost-benefit analysis is to develop both input and output measures that can be specified in the same units. The most feasible units that have been identified in this study are dollars and mathematics achievement indices. Thus, the benefits have been designated "math achievement units" in this study. The cost-benefit analysis undertaken, based on dollars and math achievement units, may be visualized in Figure 1, on the next page.

The most valid instrument employed in the project to test student achievement was the Stanford Math Achievement Test (SMAT). Hence, achievement indices (benefits) will be based on student performance on the SMAT. The SMAT was administered in a pre- and post-test sequence with two equivalent forms of the test employed to measure student achievement. The SMAT has three major sections, notably, a concept section, a computation section and an application section. The study has developed an analysis of student performance on these sub-sections of the SMAT as well as a total performance score.

GALION SEVENTH AND EIGHTH GRADE
MATHEMATICS PROJECT

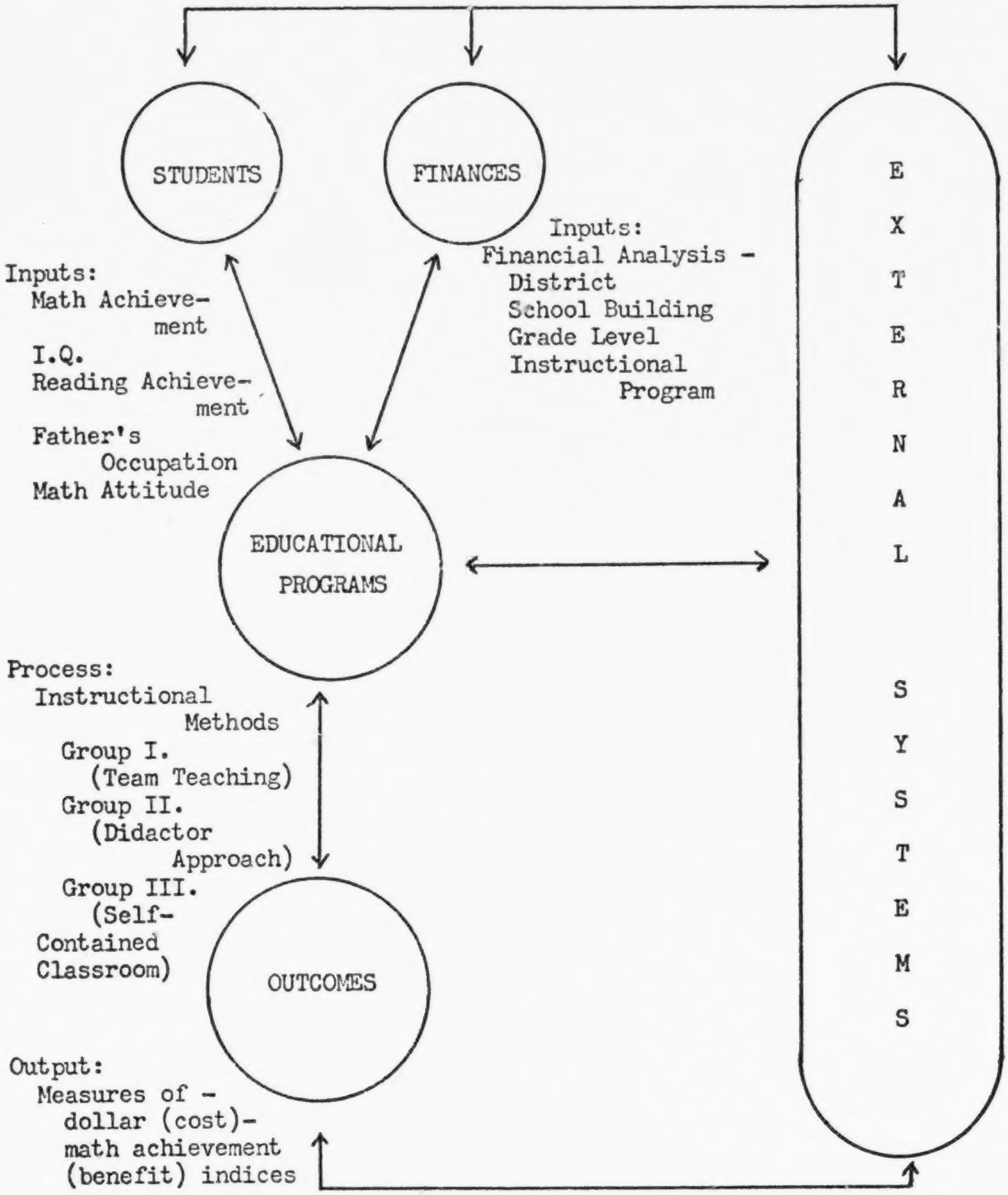

STUDENTS
FINANCES
EXTERNAL SYSTEMS
Inputs:
Math Achievement
I.Q.
Reading Achievement
Father's Occupation
Math Attitude
Inputs:
Financial Analysis -
District
School Building
Grade Level
Instructional Program
EDUCATIONAL PROGRAMS
Process:
Instructional Methods
Group I. (Team Teaching)
Group II. (Didactor Approach)
Group III. (Self-Contained Classroom)
OUTCOMES
Output:
Measures of -
dollar (cost)-
math achievement
(benefit) indices

FIGURE 1

A systematic audit of school finances of the Galion City School District was undertaken to analyze "costs" at the district level, school building level, grade level, instructional program and project instructional method level. The resulting financial cost data has been used to assign "dollar units" to the project activities. Finally the math achievement units have been related to dollar units in the form of indices for the various student groupings in the project. The presentation of these indices provides a set of decision-making alternatives which, in turn, completes the task implied in a cost-benefit analysis.

Analysis of Benefits

The three groups of students assigned to the three teaching methods for grades seven and eight have been further categorized on the basis of intelligence (IQ), reading level, father's occupation and math attitude. Each category contains three groups designated high, average and low. The criteria used for establishing these groupings have been discussed earlier in this report. It has been possible to compute achievement units (benefits) based on these groupings and categories.

Table 27 presents an analysis of the performance of seventh grade students in pre- and post-test sequences of the SMAT based on student groupings and categories discussed above. The average gain or loss in performance on the two forms of the SMAT has been designated achievement units (benefits). For example, seventh grade students participating in the self-contained classroom (Group III) with a high reading level increased their performance on an average of 3.55 achievement units from pre- to post-test administration.

TABLE 27

ANALYSIS OF ACHIEVEMENT UNITS FOR SEVENTH GRADE STUDENTS IN THE GALION PROJECT

7th Grade Grouping	Number	Average Pre-Test Score	Average Post-Test Score	Average Gain or Loss
Group I. (Team Teaching)				
I.Q.				
High	24	52.50	56.79	4.29
Average	67	35.49	39.19	3.70
Low	13	25.62	27.15	1.53
Reading Level				
High	10	60.10	63.40	3.30
Average	62	36.90	41.69	4.79
Low	32	33.16	34.81	1.65
Father's Occupation				
High	19	40.84	45.05	4.21
Average	57	39.61	42.79	3.18
Low	23	33.96	38.26	4.30
Math Attitude				
High	19	46.47	50.05	3.58
Average	48	37.79	42.40	4.61
Low	37	33.86	36.41	2.55
GroupII. (Didactor)				
I.Q.				
High	29	51.93	55.69	3.76
Average	67	38.36	40.28	1.92
Low	8	22.88	27.25	4.37
Reading Level				
High	11	53.64	59.36	5.72
Average	61	42.18	44.87	2.69
Low	32	35.56	36.84	1.28
Father's Occupation				
High	18	44.17	48.44	4.27
Average	55	42.22	44.18	1.96
Low	27	39.67	42.59	2.92
Math Attitude				
High	18	49.89	53.72	3.83
Average	39	40.36	43.59	3.23
Low	46	38.57	40.11	1.54
Group III. (Self-contained)				
I.Q.				
High	26	55.31	60.15	4.84
Average	46	38.59	44.63	6.04
Low	11	26.27	27.64	1.37

TABLE 27 (Continued)

7th grade Grouping	Number	Average Pre-Test Score	Average Post-Test Score	Average Gain or loss
Reading Level				
High	11	55.18	58.73	3.55
Average	50	43.98	49.26	5.28
Low	21	31.52	36.38	4.86
Father's Occupation				
High	15	48.93	53.47	4.54
Average	47	43.34	47.85	4.51
Low	16	34.06	39.75	5.69
Math Attitude				
High	16	47.69	52.25	4.56
Average	42	44.98	49.95	4.97
Low	24	34.00	39.13	5.13

Table 28 presents the same type of analysis for eighth grade students participating in the project. For example, eighth grade students participating in the Didactor Approach (Group II) with a low rated Father's Occupation increased their performance on an average of 1.81 achievement units from pre- to post-test administration.

TABLE 28

ANALYSIS OF ACHIEVEMENT UNITS FOR EIGHTH GRADE STUDENTS IN THE GALION PROJECT

8th Grade Grouping	Number	Average Pre-Test Score	Average Post-Test Score	Average Gain or Loss
Group I. (Team Teaching)				
I.Q.				
High	38	56.16	59.66	3.50
Average	54	39.24	42.39	3.15
Low	10	24.30	30.20	5.90
Reading Level				
High	40	52.20	56.05	3.85
Average	54	39.81	42.72	2.91
Low	8	32.25	38.63	6.38

TABLE 28 (Continued)

8th Grade Grouping	Number	Average Pre-Test Score	Average Post-Test Score	Average Gain or Loss
Father's Occupation				
High	21	52.86	54.38	1.52
Average	51	43.31	47.39	4.08
Low	26	38.27	41.92	3.65
Math Attitude				
High	23	55.52	57.00	1.48
Average	44	43.82	47.59	3.77
Low	35	37.63	41.94	4.31
Group II. (Didactor)				
I.Q.				
High	32	58.22	59.56	1.34
Average	58	41.41	41.40	(-) .01
Low	11	28.27	32.45	4.18
Reading Level				
High	32	58.03	58.91	.88
Average	55	40.87	42.11	1.24
Low	14	33.64	33.07	(-) .57
Father's Occupation				
High	11	54.64	56.36	1.72
Average	52	46.37	46.63	.26
Low	33	41.61	43.42	1.81
Math Attitude				
High	13	59.23	62.92	3.69
Average	51	47.80	48.88	1.08
Low	37	36.97	36.57	(-) .40
Group III. (Self-contained)				
I.Q.				
High	23	62.13	63.91	1.78
Average	45	41.91	43.33	1.42
Low	7	30.71	29.71	(-) 1.00
Reading Level				
High	27	59.11	60.11	1.00
Average	43	40.67	42.28	1.61
Low	5	37.00	37.40	.40
Father's Occupation				
High	8	52.50	52.88	.38
Average	43	46.84	47.05	.21
Low	22	43.59	47.59	4.00
Math Attitude				
High	8	61.25	65.13	2.88
Average	31	51.10	53.35	2.25
Low	35	39.43	39.66	.23

The foregoing analysis of student performance is useful in assessing performance of groupings and categories of students, but not especially revealing in regard to the benefits of the three teaching methods employed in the project. Moreover, the designation of achievement units based on test scores explains little in terms of the school setting for the decision-maker. A second analysis of benefits has been added to this study in an attempt to overcome the limitations of test score achievement units.

The test scores on each of the three sections of the SMAT may be used to derive a "grade equivalent" unit.[1] The average grade equivalent (GE) and the average gain or loss in GE units for seventh grade students in each teaching method of the project and sections of the SMAT is reported in Table 29. For example, the 106 seventh grade students that participated in the team-teaching approach (Group 1) increased their performance on an average of nine months in the computation section of the SMAT. Their beginning performance was 6.0 and their ending performance was 6.9.

[1] Grade equivalent may be defined as the grade of those pupils whose median raw score is the same as the raw score in question. In other words, if the median raw score happened to be 63 for a test administered to sixth grade pupils just beginning that grade level, all raw scores of 63 have a grade equivalent of 6.0.

The generally accepted way of reporting grade equivalents is in terms of two numbers. The first of the two numbers is designated as the year and the second as the month. For example, a grade equivalent of 5.4 is the median raw score of pupils tested at the fourth month of the fifth grade. Note that the calendar year is divided in ten parts, nine representing the academic year and one representing summer vacation.

Comparing a pupil's actual grade level with his grade equivalents yielded by tests in various subject matter areas is definitely more comprehensive to many teachers, administrators, and parents than raw scores, standard scores and percentile ranks.

TABLE 29

ANALYSIS OF GRADE EQUIVALENT ACHIEVEMENT UNITS FOR SEVENTH GRADE STUDENTS IN THE GALION PROJECT

Group	Number Students	Pre-test	Post-test	Gain or Loss
		Concepts		
1	106	6.6	7.9	1.3
2	110	6.7	7.8	1.1
3	87	6.7	8.4	1.7
		Computations		
1	106	6.0	6.9	.9
2	110	6.3	7.1	.8
3	87	6.2	7.7	1.5
		Applications		
1	106	7.3	7.6	.3
2	110	7.6	7.7	.1
3	87	7.4	8.1	.7

Table 30 presents the same type of analysis for eigth grade students participating in the project. For example, the 78 eighth grade students that participated in the self-contained classroom approach (Group 3) increased their performance on an average of three months in the Application section of the SMAT. Their beginning performance was 7.9 and their ending performance was 8.2.

TABLE 30

ANALYSIS OF GRADE EQUIVALENT ACHIEVEMENT UNITS FOR EIGHTH GRADE STUDENTS IN THE GALION PROJECT

Group	Number Students	Pre-test	Post-test	Gain or Loss
		Concepts		
1	107	7.9	8.7	.8
2	107	7.7	8.6	.9
3	78	7.9	8.6	.7
		Computations		
1	107	8.1	8.4	.3
2	107	7.9	8.2	.3
3	78	7.9	8.3	.4

TABLE 30 (Continued)

Group	Number Students	Pre-test	Post-test	Gain or Loss
		Applications		
1	107	8.0	8.2	.2
2	107	8.0	8.3	.3
3	78	7.9	8.2	.3

The performances on the three sections of the SMAT have been combined to derive an average GE for each teaching method by grade level. Table 31 presents the GE for average total performance of these groups. For example, the 78 eighth grade students participating in the self-contained classroom approach (Group 3) increased their performance on an average of five months on all sections of the SMAT. Their beginning performance was 7.9 and their ending performance was 8.4.

TABLE 31

ANALYSIS OF GRADE EQUIVALENT ACHIEVEMENT UNITS FOR
SEVENTH AND EIGHTH GRADE STUDENTS IN THE GALION PROJECT

Group	Number Students	Pre-test	Post-test	Gain or Loss
		Seventh Grade		
1	106	6.6	7.5	.9
2	110	6.9	7.5	.6
3	87	6.8	8.1	1.3
		Eighth Grade		
1	107	8.0	8.4	.4
2	107	7.9	8.4	.5
3	78	7.9	8.4	.5

Analysis of Costs

The Galion City School District expenditures for the 1971-72 school year were audited to obtain cost data. An attempt has been made to relate each expenditure to school building, grade level, instructional program and project instructional method. When it has not been possible to relate the expenditures in a direct fashion, the cost has been assigned on the basis of the following indices:

A. Number of students served by the activity.

B. Teacher instructional time allocated (average number of minutes per day or week for the activity).

C. Instructional space in educational facilities used for the activity

The results of financial audit and cost determinations are described in Tables 32 and 33.

The Galion City School District enrolled 3,947 students counting kindergarten as one-half on October 15, 1971. 698 of these students were housed at Galion Middle School serving grades 7 and 8 plus a special education class. 341 students were classified as seventh graders and 337 students were classified as eighth graders. 28 classroom teachers were assigned to these children. The school day was scheduled with 8 class periods of approximately 40 minutes in length. There were 18 sections of math scheduled in the school and these sections were taught by 4 teachers and one aide. It is estimated that the building contains 61,000 square feet and that the math program utilizes nearly 4,800 square feet of this space. Based on the foregoing data and personnel and financial reports the following cost analysis has been developed.

TABLE 32. ANALYSIS OF COSTS FOR THE GALION CITY SCHOOL DISTRICT AND THE SEVENTH GRADE MATH PROJECT, 1971-72 SCHOOL YEAR

Expenditures	District	Middle School	7th Grade	7th Math Program	7th Grade Group I	7th Grade Group II	7th Grade Group III
Administration	$ 65,510.66	$ 11,582.28	$ 5,824.73	$ 582.47	$ 203.86	$ 209.69	$ 168.92
Instruction	1,828,414.36	323,263.66	162,569.29	.00	.00	.00	.00
Coordinate Act.	10,383.00	1,835.71	923.18	92.32	32.31	33.24	26.77
Auxil. Agencies	387,705.95	68,546.41	34,471.99	3,447.20	1,206.52	1,240.99	999.69
Transportation	65,173.18	11,522.62	5,794.73	579.47	202.81	208.61	168.05
Operation of Plant	301,614.76	53,325.49	26,817.39	2,681.74	938.61	965.43	777.70
Maintenance of Plant	97,927.60	17,313.60	8,707.01	870.70	304.75	313.45	252.50
Capital Outlay	10,581.54	1,870.82	940.84	94.09	32.93	33.87	27.29
Gen. Fund Transfers	11,485.12	2,030.57	1,021.17	102.12	35.74	36.76	29.62
Total Gen. Fund	$2,778,796.17	$491,291.16	$247,070.33	$ 8,450.11	$ 2,957.53	$ 3,042.04	$ 2,450.54
Debt Service	808.591.82	142,959.03	71,894.10	7,189.41	2,516.29	2,588.19	2,084.93
Total	$3,587,387.99	$634,250.19	$318,964.43	$15,639.52	$ 5,473.82	$ 5,630.23	$ 4,535.47
ESEA Title I	12,685.00	2,242.71	1,127.86	112.79	39.48	40.60	32.71
ESEA Title II	5,385.04	952.08	478.80	47.88	16.76	17.24	13.88
ESEA Title III	52,449.77	52,449.77	26,376.99	26,376.99	7,805.87	13,091.45	5,479.67
NDEA	696.47	123.14	61.93	6.19	2.16	2.23	1.80
Total	$3,658,604.27	$690,017.89	$325,296.47	$42,183.37	$13,338.09	$18,781.75	$10,063.53

TABLE 33. ANALYSIS OF COSTS FOR THE GALION CITY SCHOOL DISTRICT AND THE EIGHTH GRADE MATH PROJECT, 1971-72 SCHOOL YEAR

Expenditures	District	Middle School	8th Grade	8th Math Program	8th Grade Group I	8th Grade Group II	8th Grade Group III
Administration	$ 65,510.66	$ 11,582.28	$ 5,757.55	$ 575.76	$ 213.03	$ 213.03	$ 149.70
Instruction	1,828,414.36	323,263.66	160,694.37	.00	.00	.00	.00
Coordinate Act.	10,383.00	1,835.71	912.53	91.25	33.76	33.76	23.73
Auxil. Agencies	387,705.95	68,546.41	34,074.42	3,407.44	1,260.75	1,260.75	885.94
Transportation	65,173.18	11,522.62	5,727.89	572.79	211.93	211.93	148.93
Operation of Plant	301.614.76	53,325.49	26,508.10	2,650.81	980.80	980.80	689.21
Maintenance of Plant	97,927.60	17,313.60	8,606.59	860.66	318.44	318.44	223.78
Capital Outlay	10,581.54	1,870.82	929.98	93.00	34.41	34.41	24.18
Gen. Fund Transfers	11,485.12	2,030.57	1,009.40	100.94	37.35	37.35	26.24
Total Gen. Fund	$2,778,796.17	$491,291.16	$244,220.83	$ 8,352.65	$ 3,090.47	$ 3,090.47	$2,171.71
Debt Service	808,591.82	142,959.03	71,064.93	7,106.49	2,629.40	2,629.40	1,847.69
Total	$3,587,387.99	$634,250.19	$315,285.76	$15,459.14	$ 5,719.87	$ 5,719.87	$4,019.40
ESEA Title I	12,685.00	2,242.71	1,119.85	111.49	41.25	41.25	28.99
ESEA Title II	5,385.04	952.08	473.28	47.33	17.51	17.51	12.31
ESEA Title III	52,449.77	52,449.77	26,072.78	26,072.78	7,802.59	13,036.96	5,233.23
NDEA	696.47	123.14	61.21	6.12	2.26	2.26	1.60
Total	$3,658,604.27	$690,017.89	$321,544.77	$41,696.86	$13,583.48	$18,817.85	$9,295.53

Tables 34, 35, 36 and 37 are presentations of cost benefit analysis based on achievement unit scores and achievement unit grade equivalents. These presentations may be thought of as decision-making alternatives. Please note, as these data are used as the basis for decisions, caution should be employed. It is impossible to select a policy which simultaneously maximizes benefit and minimizes cost. Maximum benefits are infinitely large, and minimum cost is zero. Thus, to seek a policy that maximizes benefit and minimizes cost is entirely fruitless.

TABLE 34

COST-BENEFIT ANALYSIS BASED ON SMAT SCORES AS ACHIEVEMENT UNITS FOR SEVENTH GRADERS IN GALION PROJECT

Grouping	No. of Students	Average Gain or Loss	Cost for Group	Units of Achievement for group	Cost per Achievement Unit per Pupil
Group I. (Team Teaching)	106	3.64	$13,338.09	385.84	$34.57
I.Q.					
High	24	4.29	3,019.92	102.96	29.33
Average	67	3.70	8,430.61	247.90	34.01
Low	13	1.53	1,635.79	19.89	82.24
Reading Level					
High	10	3.30	1,258.30	33.00	38.13
Average	62	4.79	7,801.46	296.98	26.27
Low	32	1.65	4,026.56	52.80	76.26
Father's Occupation					
High	19	4.21	2,390.77	79.99	29.89
Average	57	3.18	7,172.31	181.26	39.57
Low	23	4.30	2,894.09	98.90	29.26
Math Attitude					
High	19	3.58	2,390.77	68.02	35.14
Average	48	4.61	6,039.84	221.28	27.29
Low	37	2.55	4,655.71	94.35	49.34

TABLE 34 (Continued)

Grouping	No. of Students	Average Gain or Loss	Cost for Group	Units of Achievement for Group	Cost Per Achievement Unit Per Pupil
Group II. (Didactor)	110	2.60	$18,781.75	286.00	$ 65.67
I.Q.					
High	29	3.76	4,951.46	109.04	45.41
Average	67	1.92	11,439.58	128.64	88.93
Low	8	4.37	1,365.92	34.96	39.07
Reading Level					
High	11	5.72	1,878.14	62.92	29.85
Average	61	2.69	10,415.14	164.09	63.47
Low	32	1.28	5,463.68	40.96	133.39
Father's Occupation					
High	18	4.27	3,073.32	76.86	39.99
Average	55	1.96	9,390.70	107.80	87.11
Low	27	2.92	4,609.98	78.84	58.47
Math Attitude					
High	18	3.83	3,073.32	68.94	44.58
Average	39	3.23	6,658.86	125.97	52.86
Low	46	1.54	7,854.04	70.84	110.87
Group III. (Self-contained)	87	4.92	10,063.53	428.04	23.51
I.Q.					
High	26	4.84	3,007.42	125.84	23.90
Average	46	6.04	5,320.82	277.84	19.15
Low	11	1.37	1,272.37	15.07	84.43
Reading Level					
High	11	3.55	1,272.37	39.05	32.58
Average	50	5.28	5,783.50	264.00	21.91
Low	21	4.86	2,429.07	102.06	23.80
Father's Occupation					
High	15	4.54	1,735.05	68.10	25.48
Average	47	4.51	5,436.49	211.97	25.65
Low	16	5.69	1,850.72	91.04	20.33
Math Attitude					
High	16	4.56	1,850.72	72.96	25.37
Average	42	4.97	4,858.14	208.74	23.27
Low	24	5.13	2,776.08	123.12	22.55

TABLE 35

COST-BENEFIT ANALYSIS BASED ON SMAT SCORES AS ACHIEVEMENT UNITS FOR EIGHT GRADERS IN GALION PROJECT

Grouping	No. of Students	Average Gain or Loss	Cost for Group	Units of Achievement for Group	Cost Per Achievement Unit Per Pupil
Group I. (Team Teaching)	107	4.64	$13,583.48	496.48	$27.36
I.Q.					
High	38	3.50	4,824.10	133.00	36.27
Average	54	3.15	6,855.30	170.10	40.30
Low	10	5.90	1,269.50	59.00	21.52
Reading Level					
High	40	3.85	5,078.00	154.00	32.97
Average	54	2.91	6,855.30	157.14	43.63
Low	8	6.38	1,015.60	51.04	19.90
Father's Occupation					
High	21	1.52	2,665.95	31.92	83.52
Average	51	4.08	6,474.45	208.08	31.12
Low	26	3.65	3,300.70	94.90	34.78
Math Attitude					
High	23	1.48	2,919.85	34.04	85.78
Average	44	3.77	5,585.80	165.88	33.67
Low	35	4.31	4,443.25	150.85	29.45
Group II. (Didactor)					
I.Q.					
High	32	1.34	5.627.84	42.88	131.25
Average	58	Loss	10,200.46	Loss	175.87
Low	11	4.18	1,934.57	45.98	42.07
Reading Level					
High	32	.88	5,627.84	28.16	175.87
Average	55	1.24	9,672.85	68.20	141.83
Low	14	Loss	2,462.18	Loss	175.87
Father's Occupation					
High	11	1.72	1,934.57	18.92	102.25
Average	52	.26	9,145.24	13.52	175.87
Low	33	1.81	5,803.71	59.73	97.17
Math Attitude					
High	13	3.69	2,286.31	47.97	47.66
Average	51	1.08	8,969.37	55.08	162.84
Low	37	Loss	6,507.19	Loss	175.87

TABLE 35 (Continued)

Grouping	No. of Students	Average Gain or Loss	Cost for Group	Units of Achievement for group	Cost per Achievement Unit per Pupil
Group III. (Self-contained)	78	1.59	$9,295.53	124.02	$74.95
I.Q.					
High	23	1.78	2,740.91	40.94	66.95
Average	45	1.42	5,362.65	63.90	83.92
Low	7	Loss	834.19	Loss	119.17
Reading Level					
High	27	1.00	3,217.59	27.00	119.17
Average	43	1.61	5,124.31	69.23	74.02
Low	5	.40	595.85	2.00	119.17
Father's Occupation					
High	8	.38	953.36	3.04	119.17
Average	43	.21	5,124.31	9.03	119.17
Low	22	4.00	2,621.74	88.00	29.79
Math Attitude					
High	8	2.88	953.36	23.04	41.38
Average	31	2.25	3,694.27	69.75	52.96
Low	35	.23	4,170.95	8.05	119.17

TABLE 36

SUMMARY OF COST-BENEFIT ANALYSIS BASED ON SMAT SCORES AS ACHIEVEMENT UNITS

Group	Cost Per Unit-Seventh Grade	Cost Per Unit-Eighth Grade
I	$34.57	$ 27.36
II	65.67	165.91
III	23.51	74.95

TABLE 37

COST-BENEFIT ANALYSIS BASED ON SMAT GRADE EQUIVALENTS FOR SEVENTH AND EIGHTH GRADERS IN GALION PROJECT

Group	Number of Students In Group	Average Gain or Loss of G.E.	Cost For Group	G.E. Units of Achievement For Group	Cost Per G.E. Unit of Achievement Per Pupil[a]
			Seventh Grade		
1	106	.9	$13,338.09	95.4	$13.98
2	110	.6	18,781.75	66.0	28.46
3	87	1.3	10,063.53	113.1	8.90
			Eighth Grade		
1	107	.4	$13,583.48	42.8	$31.74
2	107	.5	18,817.85	53.5	35.17
3	78	.5	9,295.53	39.0	23.83

[a] Each unit of achievement represents one month of achievement growth as measured by the SMAT for each pupil.

CHAPTER 5

SUMMARY, CONCLUSIONS, RECOMMENDATIONS

The first section of this chapter presents a summary of the major findings. These findings and discussions thereof have been presented here-to-fore and this section merely serves as a summary of the findings.

A. Achievement

The major findings of the study are based on the 1971-1972 seventh graders and on their achievement as noted by the Stanford Arithmetic Test. This summary will attempt, when possible, to draw similarities between the Stanford results and the project test results.

The following list of findings is deemed appropriate:

A. For entire class analyses

1. Arithmetic computations -- mean of the self-contained classes significantly higher than the means of the team teaching and didactor approaches (Table 2). Same general trend present in Table 12 -- Section B of the project test.
2. Arithmetic concepts --mean of the self-contained classes significantly higher than the means of the team teaching and didactor approaches (Table 3). Same finding for the project test (Table 11).
3. Arithmetic applications -- mean of the self-contained classes significantly higher than the means of the team teaching and didactor approaches (Table 4). Table 13 for the project test did not show a trend nor significance.

4. For total arithmetic -- mean of the self-contained classes significantly higher than the means of the team teaching and didactor approaches (Table 5). Same trends and partial findings are present in Table 14 for the project test.
5. Reading -- no significant differences between the means of the three approaches (Table 6).
6. Pupil attitudes toward arithmetic -- no significant differences between the means of the three approaches (Tables 7, 9, and 10).
7. Pupil attitudes toward teaching machines -- no significant differences between the means of the three approaches at the seventh grade level -- didactor students at the eighth grade level thought significantly less of machines than did the other two groups (Table 8).

B. For Specific Blocks of Students

1. I.Q. Blocks
    a. Average I.Q.'s -- computations

       The mean of the self-contained approach was significantly higher than the means of the other two approaches (Table 15A).
    b. Average I.Q.'s -- concepts

       The mean of the self-contained approach was significantly higher than the mean of the didactor approach (Table 16A).
    c. Low I.Q.'s -- applications

       The mean of the didactor approach was significantly higher than the mean of the self-contained approach (Table 17).
    d. Average I.Q.'s -- total arithmetic

       The mean of the self-contained approach was significantly higher than the means of the other two approaches (Table 15 A).

d. This finding verified for total project test (Table 19A).

2. Reading Blocks

a. Average readers

The mean of the self-contained approach was significantly higher than the mean of the didactor approach (Table 20A). For project test, the mean of the self-contained group was significantly higher than the means of the other two groups (Table 21A).

3. Socio - Economic Blocks

a. No reliable trend of one method being superior to any other for the Stanford Arithmetic Test.

4. Attitude Levels

a. No reliable trend of one method being superior to any other for the Stanford Arithmetic Test.

C. Cost - Benefit

Table 37 from Chapter 4 is reproduced below:

TABLE 37

COST-BENEFIT ANALYSIS BASED ON SMAT GRADE EQUIVALENTS FOR SEVENTH AND EIGHTH GRADERS IN GALION PROJECT

Seventh Grade

Group	Number of Students In Group	Average Gain or Loss of G.E.	Cost For Group	G.E. Units of Achievement For Group	Cost per G.E. Unit of Achievement Per Pupil[a]
1	106	.9	$13,338.09	95.4	$13.98
2	110	.6	18,781.75	66.0	28.46
3	87	1.3	10,063.53	113.1	8.90

TABLE 37

(continued)

Group	Number of Students in Group	Average Gain or Loss of G.E.	Cost For Group	G.E. Units of Achievement For Group	Cost Per G.E. Unit of Achievement Per Pupil[a]
			Eighth Grade		
1	107	.4	$13,583.48	42.8	$31.74
2	107	.5	18,817.85	53.5	35.17
3	78	.5	9,295.53	39.0	23.83

[a] Each unit of achievement represents one month of achievement growth as measured by the SMAT for each pupil.

A summary of the Cost - benefit analysis, especially for the seventh grade, could well be that the self-contained classroom method had the best cost - benefit ratio -- team teaching second best -- and didactor the poorest.

Conclusion.

The conclusion of the study is based upon the following major limitations and/or restrictions:

1. Arithmetic Achievement as measured by the Stanford Arithmetic Test.
2. The 1971-72 Galion seventh graders.
3. The teaching and administrative personnel involved in the experiment.
4. The design of the experiment and the analyses performed upon the gathered data.

With these limitations/restrictions in mind, the following conclusion is offered:

The team-teaching and didactor approaches failed to demonstrate any major superiority over the one-teacher self-contained classroom approach. The students taught by the one-teacher self-contained approach were able, in general, to answer more test items correctly than were students in the other two groups. In addition, the cost-benefit ratio of the self-contained classroom was more positive than were similar ratios for the other two groups.

Recommendations.

With the above limitations/restrictions, conclusions and summary of findings serving as a frame of reference, the following recommendations are offered for consideration by the Galion School officials:

1. To accept the premise that the "best" method (of those under consideration) -- in terms of achievement and cost-benefit is that of a dynamic, enthusiastic, well-versed teacher with a heterogeneous class of pupils of size 30 or less.
2. To continue experimenting/studying the team-teaching situation -- achievement is somewhere in the middle of the self-contained and didactor approaches and the cost-benefit ratio compares favorably to that of the self-contained classes.
3. If the philosophy (and scheduling structure) of the Galion Schools permits outright segregation of students, further experimentation/study of the low I.Q. students with the didactors might be warranted. If not, it is suggested that the didactors be divided among all the math teachers and that they use them as supplementary teaching aids.

APPENDIX 1

ATTITUDE FORMS

On the answer sheet, please:

1. Print your name, last name first.
2. Write date of this test.
3. Write name of your math instructor (a) Cook, (b) Fullerton, (c) Huguenin.

DIRECTIONS

1. This twelve-question survey, which is presented on the next three pages, is to let you describe how you feel or what you think. Most of the questions pertain to how you think about arithmetic.

2. Show what you think by placing a mark in one of the five spaces on the answer sheet.

    For example, how do you feel about dogs?

    Dogs are?

    A B C D E
    1. Good == == == == == Bad
    2. Kind == == == == == Cruel

    If you feel that dogs are very good, you would make a mark under "A"; if you thought dogs were just so-so, you would make a mark in the middle space, "C"; if you thought dogs were bad, you would make a mark under E (next to Bad).

    Do you think dogs are kind or cruel or somewhere in between? Make a mark showing how you think dogs are in relation to being kind or cruel. (Now erase the mark you made!)

3. Use only one mark for each pair of adjectives.

4. There are no right or wrong answers. Your first thought is usually the best one to record.

5. Work quickly. If you have any questions, ask your teacher.

DO NOT MARK ON THIS PAPER--JUST MARK ON THE ANSWER SHEET

YOU MUST USE A LEAD PENCIL!

PLEASE DO NOT MARK ON THIS PAPER!

A. I am?

	A	B	C	D	E	
1 Good	==	==	==	==	==	Bad
2 Weak	==	==	==	==	==	Strong
3 Sad	==	==	==	==	==	Happy
4 Wise	==	==	==	==	==	Foolish
5 Brave	==	==	==	==	==	Cowardly
6 Dirty	==	==	==	==	==	Clean
7 Kind	==	==	==	==	==	Cruel
8 Important	==	==	==	==	==	Unimportant
9 Cold	==	==	==	==	==	Hot

B. Small, special classes are?

	A	B	C	D	E	
10 Good	==	==	==	==	==	Bad
11 Weak	==	==	==	==	==	Strong
12 Sad	==	==	==	==	==	Happy
13 Wise	==	==	==	==	==	Foolish
14 Brave	==	==	==	==	==	Cowardly
15 Dirty	==	==	==	==	==	Clean
16 Kind	==	==	==	==	==	Cruel
17 Important	==	==	==	==	==	Unimportant
18 Cold	==	==	==	==	==	Hot

C. Arithmetic is?

	A	B	C	D	E	
19 Good	==	==	==	==	==	Bad
20 Weak	==	==	==	==	==	Strong
21 Sad	==	==	==	==	==	Happy
22 Wise	==	==	==	==	==	Foolish
23 Brave	==	==	==	==	==	Cowardly
24 Dirty	==	==	==	==	==	Clean
25 Kind	==	==	==	==	==	Cruel
26 Important	==	==	==	==	==	Unimportant
27 Cold	==	==	==	==	==	Hot

D. Subtraction problems are?

	A	B	C	D	E	
28 Good	==	==	==	==	==	Bad
29 Weak	==	==	==	==	==	Strong
30 Sad	==	==	==	==	==	Happy
31 Wise	==	==	==	==	==	Foolish
32 Brave	==	==	==	==	==	Cowardly
33 Dirty	==	==	==	==	==	Clean
34 Kind	==	==	==	==	==	Cruel
35 Important	==	==	==	==	==	Unimportant
36 Cold	==	==	==	==	==	Hot

PLEASE DO NOT MARK ON THIS PAPER!

E. Arithmetic classes are?

A B C D E
37 Good == == == == == Bad
38 Weak == == == == == Strong
39 Sad == == == == == Happy
40 Wise == == == == == Foolish
41 Brave == == == == == Cowardly
42 Dirty == == == == == Clean
43 Kind == == == == == Cruel
44 Important == == == == == Unimportant
45 Cold == == == == == Hot

F. Arithmetic Word Problems are?

A B C D E
46 Good == == == == == Bad
47 Weak == == == == == Strong
48 Sad == == == == == Happy
49 Wise == == == == == Foolish
50 Brave == == == == == Cowardly
51 Dirty == == == == == Clean
52 Kind == == == == == Cruel
53 Important == == == == == Unimportant
54 Cold == == == == == Hot

G. Arithmetic Teachers are?

A B C D E
55 Good == == == == == Bad
56 Weak == == == == == Strong
57 Sad == == == == == Happy
58 Wise == == == == == Foolish
59 Brave == == == == == Cowardly
60 Dirty == == == == == Clean
61 Kind == == == == == Cruel
62 Important == == == == == Unimportant
63 Cold == == == == == Hot

H. Working with Teaching Machines (Didactor, etc.) is?

A B C D E
64 Good == == == == == Bad
65 Weak == == == == == Strong
66 Sad == == == == == Happy
67 Wise == == == == == Foolish
68 Brave == == == == == Cowardly
69 Dirty == == == == == Clean
70 Kind == == == == == Cruel
71 Important == == == == == Unimportant
72 Cold == == == == == Hot

PLEASE DO NOT MARK ON THIS PAPER!

I. Arithmetic and me?

		A	B	C	D	E	
73	Good	==	==	==	==	==	Bad
74	Weak	==	==	==	==	==	Strong
75	Sad	==	==	==	==	==	Happy
76	Wise	==	==	==	==	==	Foolish
77	Brave	==	==	==	==	==	Cowardly
78	Dirty	==	==	==	==	==	Clean
79	Kind	==	==	==	==	==	Cruel
80	Important	==	==	==	==	==	Unimportant
81	Cold	==	==	==	==	==	Hot

J. Arithmetic and Mother?

		A	B	C	D	E	
82	Good	==	==	==	==	==	Bad
83	Weak	==	==	==	==	==	Strong
84	Sad	==	==	==	==	==	Happy
85	Wise	==	==	==	==	==	Foolish
86	Brave	==	==	==	==	==	Cowardly
87	Dirty	==	==	==	==	==	Clean
88	Kind	==	==	==	==	==	Cruel
89	Important	==	==	==	==	==	Unimportant
90	Cold	==	==	==	==	==	Hot

K. Arithmetic and Father?

		A	B	C	D	E	
91	Good	==	==	==	==	==	Bad
92	Weak	==	==	==	==	==	Strong
93	Sad	==	==	==	==	==	Happy
94	Wise	==	==	==	==	==	Foolish
95	Brave	==	==	==	==	==	Cowardly
96	Dirty	==	==	==	==	==	Clean
97	Kind	==	==	==	==	==	Cruel
98	Important	==	==	==	==	==	Unimportant
99	Cold	==	==	==	==	==	Hot

L. What are your feelings concerning high school math?

		A	B	C	D	E	
100	Good	==	==	==	==	==	Bad
101	Weak	==	==	==	==	==	Strong
102	Sad	==	==	==	==	==	Happy
103	Wise	==	==	==	==	==	Foolish
104	Brave	==	==	==	==	==	Cowardly
105	Dirty	==	==	==	==	==	Clean
106	Kind	==	==	==	==	==	Cruel
107	Important	==	==	==	==	==	Unimportant
108	Cold	==	==	==	==	==	Hot

This test is different from the one you just finished. Read the statements below. Decide whether you strongly agree (SA), agree (A), are undecided (U), disagree (D), or strongly disagree (SD). If you strongly agree with statement 109, make a mark under A for question 109 on the answer sheet. If you strongly disagree, make a mark under E, etc. Mark the rest of the questions in a similar manner.

DO NOT MARK ON THIS PAPER

	SA	A	U	D	SD
	A	B	C	D	E
109. Working with numbers is fun.	==	==	==	==	==
110. Arithmetic should be avoided whenever possible.	==	==	==	==	==
11. Discovering solutions to mathematical problems is exciting.	==	==	==	==	==
112. Arithmetic is good because it makes you think.	==	==	==	==	==
113. It is fun to think about arithmetic problems outside of class.	==	==	==	==	==
114. Word problems are frustrating.	==	==	==	==	==
115. Doing arithmetic problems is boring.	==	==	==	==	==
116. One cannot use mathematics in daily life.	==	==	==	==	==
117. Arithmetic is very interesting.	==	==	==	==	==
118. Discovering solutions to mathematical problems is frustrating.	==	==	==	==	==
119. Arithmetic is a stimulating activity.	==	==	==	==	==
120. Arithmetic is too complicated.	==	==	==	==	==
121. Arithmetic is logical.	==	==	==	==	==
122. Arithmetic is necessary in daily life.	==	==	==	==	==
123. There are too many steps needed in getting the answer to an arithmetic problem.	==	==	==	==	==
124. There are too many chances to make a mistake in arithmetic.	==	==	==	==	==
125. Arithmetic is practical.	==	==	==	==	==
126. Arithmetic takes too long.	==	==	==	==	==
127. Working with numbers presents a challenge.	==	==	==	==	==
128. Most word problems are not practical.	==	==	==	==	==
129. Mathematics is frightening.	==	==	==	==	==
130. Arithmetic is a waste of time.	==	==	==	==	==
131. It is fun to play with numbers.	==	==	==	==	==
132. There are too many rules to learn in arithmetic.	==	==	==	==	==
133. Discovering the solutions to mathematics is rewarding.	==	==	==	==	==

APPENDIX 2

PROJECT TEST

BOOKLET A

ARITHMETIC CONCEPTS

1. DO NOT TURN THIS PAGE UNTIL TOLD TO DO SO!

2. DO NOT MAKE ANY MARKS ON THIS BOOKLET!

3. YOU WILL HAVE 30 MINUTES TO COMPLETE THIS TEST. THE TEACHER WILL TELL YOU WHEN TO BEGIN AND WHEN TO STOP.

4. DO NOT BE DISCOURAGED IF YOU COME TO A PROBLEM YOU CANNOT ANSWER--SKIP IT AND ATTEMPT TO ANSWER THE NEXT QUESTION.

5. DO NOT GUESS ANY ANSWERS--PLEASE LEAVE IT BLANK UNLESS YOU ARE FAIRLY SURE YOU HAVE A CORRECT ANSWER.

DO NOT
MARK ON
THIS
PAPER

1. In the number 2165, which digit has the greatest value?

A) 2 C) 6
B) 1 D) 5
E) Answer not given

2. In which pair are the fractional numbers equal?

A) $\frac{3}{5}$ $\frac{4}{5}$ C) $\frac{3}{5}$ $\frac{3}{8}$
B) $\frac{3}{5}$ $\frac{6}{10}$ D) $\frac{4}{5}$ $\frac{6}{10}$
E) Answer not given

3. Which of these is the longest?

A) 50 wk. C) 11 mo.
B) 1 yr. D) 360 da.
E) 1 leap year

4. Which of these can be added without any change?

A) $\frac{1}{2} + \frac{3}{6}$ C) $\frac{1}{5} + \frac{3}{5}$
B) $\frac{3}{5} + \frac{4}{6}$ D) $\frac{1}{2} + \frac{1}{5}$
E) Answer not given

5. How would one write the time for 15 minutes before midnight?

A) 12:15 A.M. C) 11:45 A.M.
B) 12:15 P.M. D) 11:45 P.M.
E) Answer not given

6. Which of these is the longest?

A) 2 yd. C) 42 in.
B) 3 ft. 2 in. D) 1 yd. 2 ft.
E) 4 ft. 3 in.

7. Which of these fractions is greater than 1?

A) $\frac{7}{8}$ C) $\frac{6}{6}$
B) $\frac{7}{6}$ D) $\frac{4}{5}$
E) $\frac{11}{12}$

8. If 163 is rounded off to the nearest ten, what is the resulting number?

A) 160 C) 170
B) 162 D) 200
E) 150

9. Which of these is the least?

A) 1 lb. 10 oz. C) 1.5 lb.
B) 1¼ lb. D) 14 oz.
E) ½ lb.

10. Which of these addition examples is represented by the shaded parts of the diagrams below?

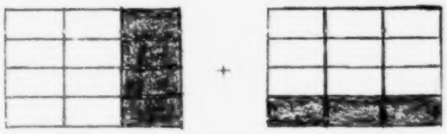
A) $\frac{1}{2} + \frac{1}{3}$

B) $\frac{2}{3} + \frac{3}{4}$

C) $\frac{2}{3} + \frac{1}{4}$

D) $\frac{1}{3} + \frac{1}{4}$

E) $\frac{4}{9} + \frac{3}{9}$

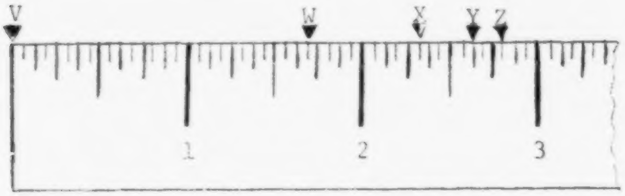


11. How would you write five hundred six thousand seventy-two as a numeral?

A) 506,072
B) 500,672
C) 506,72
D) 506,702
E) 50,600,072

12. The automobile distance from Galion to Cincinnati is about 200 miles. Which of these best explains the meaning of "about 200 miles"?

A) Slightly more than 200 miles
B) Slightly less than 200 miles
C) Exactly 200 miles
D) Either slightly more or slightly less than 200 miles
E) Answer not given



DO NOT
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THIS PAPER

13. Which of these distances along the ruler above is $2\frac{5}{16}$ in.?

A) V to W
B) V to X
C) V to Y
D) V to Z
E) Answer not given

14. If 23.49 is rounded off to the nearest whole number, what is the result?

A) 20
B) 23
C) 24
D) 25
D) 23.5

15. Which of these would be the best bargain for a customer?

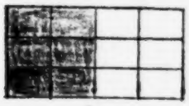
A) $\frac{1}{4}$ off
B) $\frac{1}{5}$ off
C) $\frac{1}{3}$ off
D) $\frac{1}{10}$ off
E) 20% off

16. Broadcast time for a New Year's Day football game in Chicago is 1:15 P.M. At what time should a person in New York tune in for this broadcast?

A) 2:15 P.M
B) 1:15 P.M.
C) 12:15 P.M.
D) 11:15 A.M.
E) Answer not given

17. How would you read 65,009,000,000?

A) 65 billion, 9 million
B) 65 million, 900 thousand
C) 65 trillion 9 billion
D) 65 billion, 900 thousand
E) Answer not given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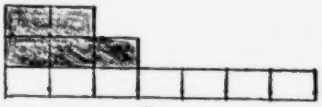
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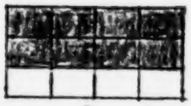
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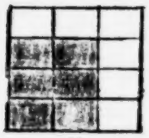
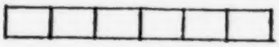

4

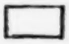
18. Which of the diagrams above shows $\frac{2}{3}$ of 12?

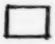
A) 1 B) 2 C) 3 D) 4 E) Answer not given

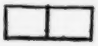
19. Which of these figures is one-third of figure 1?

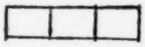
A) 2
B) 3
C) 4
D) 5
E) Answer not given

1. 

2. 

3. 

4. 

5. 

20. How would you read 58.09?

A) 58 and 9 hundreds
B) 58 and 9 tenths
C) 58 point 9
D) 58 and nine hundredths
E) Answer not given

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21. Which of these represents the largest number?

A) 1.24 B) 1.183 C) .915 D) 1.3 E) 1.0098

22. How is MDCXLIV expressed in our system?

A) 1644 B) 1466 C) 1444 D) 1664 E) Answer not given

23. Which of these numerals has a 2 in the hundreds place and a 3 in the hundredths place?

A) 430.128 B) 319.625 C) 258.136 D) 217.483
E) Answer not given

24. In which case is 94,839,071 rounded off to the nearest million?

A) 94,000,000 B) 94,800,000 C) 94,900,000 D) 95,000,000
E) Answer not given

25. If 3.146 is rounded off to the nearest tenth, what is the result?

A) 3.0   B) 3.1   C) 3.2   D) 3.5   E) Answer not given

26. Which of these numbers is the closest approximate expression for $10,759,586,067?

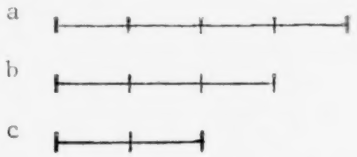
A) $10.5 billion   B) $10.7 billion   C) $10.8 billion
D) $11.0 billion   E) Answer not given

27. Hou would you write .019 as a per cent?

A) 1.9%   B) .019%   C) 19%   D) .19%   E) .19%

28. Which pair of line segments is 2 to 1 in length?

A) a to b
B) a to c
C) b to c
D) c to a
E) Answer not given



29. If a circle is drawn with the points of the compas 3 inches apart, what part of the circle would be 3 inches in length?

A) Circumference   B) Diameter   C) Arc
D) Radius   E) Answer not given

30. Which of these numbers is the smallest?

A) .25   B) $\frac{3}{5}$ C) .8   D) $\frac{3}{4}$ E) $\frac{1}{3}$

If finished, go back and check your work.

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BOOKLET B

ARITHMETIC COMPUTATIONS

1. DO NOT TURN THIS PAGE UNTIL TOLD TO DO SO!

2. DO NOT MAKE ANY MARKS ON THIS BOOKLET!

3. YOU WILL HAVE 40 MINUTES TO COMPLETE THIS TEST. THE TEACHER WILL TELL YOU WHEN TO BEGIN AND WHEN TO STOP.

4. DO NOT BE DISCOURAGED IF YOU COME TO A PROBLEM YOU CANNOT ANSWER--SKIP IT AND ATTEMPT TO ANSWER THE NEXT QUESTION.

5. DO NOT GUESS ANY ANSWERS--PLEASE LEAVE IT BLANK UNLESS YOU ARE FAIRLY SURE YOU HAVE A CORRECT ANSWER.

31. The scale for a house plan is 1 inch represents 2 feet. How many feet are represented by a 5-inch line on the plan?

A) 2　　B) 3　　C) 6　　D) 12　　E) 10

32. Which set of fractions is arranged in order of size from smallest to largest?

A) $\frac{1}{6}, \frac{1}{4}, \frac{1}{8}$　　B) $\frac{1}{5}, \frac{1}{4}, \frac{1}{2}$　　C) $\frac{1}{3}, \frac{1}{6}, \frac{1}{5}$

D) $\frac{1}{2}, \frac{1}{3}, \frac{1}{8}$　　E) Answer not given

33. How do the fractions $\frac{3}{10}$ and $\frac{3}{5}$ compare?

A) The fractions are equal.　　C) $\frac{3}{10}$ is half as large as $\frac{3}{5}$

B) $\frac{3}{10}$ is twice as large as $\frac{3}{5}$　　D) $\frac{3}{10}$ is 2½ times as large as $\frac{3}{5}$

E) Answer not given

34. The plate in an elevator reads, "Capacity 4000 lbs." How many 200 pound people will the elevator carry safely?

A) 10　　B) 29　　C) 40　　D) 80　　E) 20

35. For the subtraction exercise $\frac{7}{8} - \frac{1}{4}$ what is the answer?

A) $\frac{1}{2}$　　B) $\frac{5}{8}$　　C) $\frac{2}{3}$　　D) $\frac{1}{20}$　　E) Answer not given

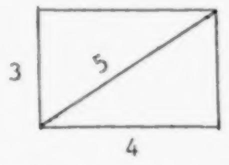
36. Which of these is a correct way to find a fractional number equal to $\frac{4}{6}$?

A) $\frac{4}{6} = \frac{4 \times 2}{6 \times 2} = \frac{8}{12}$　　B) $\frac{4}{6} = \frac{4+2}{6+2} = \frac{6}{8}$　　C) $\frac{4}{6} = \frac{4-2}{6-2} = \frac{2}{4}$

D) $\frac{4}{6} = \frac{4 \div 2}{4 \times 2} = \frac{2}{8}$　　E) Answer not given

37. Which of these is a correct way to find the perimeter of the figure below?

A) 2 X 5
B) 3 + 4
C) 3 X 4
D) 3 + 4 + 3 + 4
E) Answer not given



38. The average of 3 numbers is 15. What is their sum?

A) 45　　B) 18　　C) 9　　D) 15　　E) Answer not given

39. What is the answer to 29 X .15?

A) 1.45　　B) 3.95　　C) 4.35　　D) 1.74　　E) Answer not given

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40. What is the sum of the following numbers: .98, .13, .25, .29?

A) 1.55 B) 1.64 C) 1.65 D) 1.66 E) Answer not given

41. What is the answer when you subtract $2.39 from five dollars?

A) $2.61 B) $2.71 C) $3.39 D) $2.70 E) Answer not given

42. What is the answer when you divide 7.20 by 1.8?

A) .40 B) 4.0 C) 40 D) 5.4 E) Answer not given

43. What is the answer when you multiply $\frac{2}{3}$ by $\frac{3}{4}$?

A) $\frac{5}{7}$ B) 2 C) $\frac{1}{2}$ D) $\frac{6}{7}$ E) Answer not given

44. What is the answer when you divide 24679 by 23?

A) 173 B) 1703 C) 1073 D) 1730 E) Answer not given

45. What is $\frac{7}{8}$ as a decimal?

A) .87 B) .88 C) .875 D) 1.14 E) Answer not given

46. What is 85% as a common fraction?

A) $\frac{4}{5}$ B) $1\frac{3}{17}$ C) $\frac{5}{4}$ D) $\frac{17}{18}$ E) Answer not given

47. A gallon of floor paint covers 400 square feet. How many square feet would one quart of this paint cover?

A) 200 B) 25 C) 80 D) 50 E) Answer not given

48. For $\frac{2}{3} \div \frac{1}{5}$ what is the answer?

A) $7\frac{1}{2}$ B) $3\frac{1}{3}$ C) $\frac{2}{15}$ D) $\frac{3}{10}$ E) Answer not given

49. What is the sum of $\frac{1}{2} + \frac{1}{5} + \frac{1}{3}$?

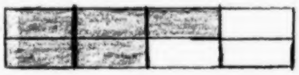
A) $\frac{3}{10}$ B) $\frac{1}{30}$ C) $\frac{13}{15}$ D) $\frac{15}{14}$ E) Answer not given

50. Which of these fractional numbers is half as large as $\frac{1}{6}$?

A) $\frac{1}{12}$ B) $\frac{1}{3}$ C) $\frac{2}{12}$ D) $\frac{2}{6}$ E) Answer not given

51. What per cent of this figure is shaded?

A) $62\frac{1}{2}$
B) $66\frac{2}{3}$
C) $83\frac{1}{3}$
D) $87\frac{1}{2}$
E) Answer not given



52. What is the area in square inches of a 5-inch square?

A) 20 B) 15 C) 10 D) 5 E) Answer not given

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53. Change $\frac{5}{6}$ to a decimal fraction.

A) 1.2 B) 1.20 C) .82 D) .825 E) Answer not given

54. Which set of fractions is arranged in order of size from smallest to largest?

A) $\frac{4}{3}, \frac{1}{6}, \frac{1}{3}$ B) $\frac{1}{4}, \frac{5}{6}, \frac{5}{8}$ C) $\frac{1}{2}, \frac{2}{5}, \frac{3}{4}$

D) $\frac{3}{4}, \frac{1}{2}, \frac{1}{3}$ E) Answer not given

55. In the exercise 12.72 ÷ .8, what is the answer?

A) 1.59 B) .159 C) 159 D) 15.9 E) Answer not given

56. Helen paid 18¢ for 3 pencils. Which of the equations below could be used to find the cost of 1 pencil?

A) $3n = 18$ B) $n + 3 = 18$ C) $\frac{n}{3} = 18$

D) $n - 3 = 18$ E) Answer not given

57. At 3 A.M. the temperature was $-6°$; at 2 P.M. it was $+27°$. How many degrees did the temperature change during the morning?

A) 20 B) 23 C) 21 D) 33 E) Answer not given

58. The formula for finding the area of a circle is $A = \pi r^2$. Find the area of a circle with a radius of 4 inches, with $\pi = 3\frac{1}{7}$.

A) $50\frac{2}{7}$ B) $\frac{11}{56}$ C) $5\frac{1}{11}$ D) $5\frac{2}{7}$ E) $\frac{56}{11}$

59. If the cost of an article is reduced 25%, what fraction of the original price is the new price?

A) $\frac{24}{25}$ B) $\frac{4}{5}$ C) $\frac{1}{4}$ D) $\frac{1}{25}$ E) $\frac{3}{4}$

60. Which of these fractions is greater than $\frac{5}{16}$ but less than $\frac{5}{8}$?

A) $\frac{1}{2}$ B) $\frac{13}{16}$ C) $\frac{1}{8}$ D) $\frac{3}{4}$ E) Answer not given

If finished, go back and check your work

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BOOKLET C

ARITHMETIC APPLICATIONS

1. DO NOT TURN THIS PAGE UNTIL TOLD TO DO SO!
2. DO NOT MAKE ANY MARKS ON THIS BOOKLET!
3. YOU WILL HAVE 40 MINUTES TO COMPLETE THIS TEST. THE TEACHER WILL TELL YOU WHEN TO BEGIN AND WHEN TO STOP.
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ADVERTISEMENT IN SPORT SHOP WINDOW:

Ping Pong Set	$4.88
Tennis Balls	3 for $1.76
Tennis Racket	$5.19
Softball	$1.68
Softball bat	$1.39
Softball gloves	$4.44
Archery Set	$4.65
Roller Skates	$3.95
Croquet Set	$6.78
Football	$3.69
Basketball	$5.79
Boxing gloves	$6.97
Punching bag	$5.38

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To work problems 61-66, look at the prices listed above. Do not allow for sales tax.

61. Galion's coach bought a dozen tennis balls. How much did they cost?

A) $5.28 B) $7.04 C) $21.12 D) $ .59 E) Answer not given

62. Jim bought a set of boxing gloves and a punching bag. He paid for them with a 20-dollar bill. How much change should he have received?

A) $7.65 B) $7.75 C) $8.75 D) $12.35 E) Answer not given

63. Mary's parents agreed to pay $\frac{2}{3}$ of the cost of a croquet set if Mary would pay $\frac{1}{3}$. How much did her parents pay?

A) $2.26 B) $3.39 C) $4.52 D) $5.48 E) Answer not given

64. Last month roller skates were on sale at 20% off. How much would Sally have paid if she had bought her skates during the sale?

A) 79¢ B) $4.74 C) $6.84 D) $3.16 E) Answer not given

65. Sam wanted to buy a bat, glove, and softball. If he saved $1.30 each week, how many weeks would it take him to save enough money?

A) 7 B) 8 C) 5 D) 6 E) Answer not given

66. The store manager paid $14.28 per dozen for the softballs. How much did he make on each ball?

A) $1.68 B) $1.19 C) $ .49 D) $2.87 E) Answer not given

67. The seventh grade passed a collection box, and each pupil gave as much as he wished. The total amount in the box was $5.76. If there were 32 pupils in the seventh grade, what was the average amount each gave?

A) 13¢ B) 18¢ C) 32¢ D) 81¢ E) Answer not given

68. John made a train trip from Chicago to New York City. The distance from Chicago to Pittsburgh was 468 miles; from Pittsburgh to Harrisburg, 245 miles; from Harrisburg to Philadelphia, 109 miles; and from Philadelphia to New York City, 86 miles. How many miles was it from Chicago to New York City by this route?

A) 898 B) 907 C) 908 D) 1008 E) Answer not given

69. Sally and her mother each chose the $1.95 plate dinner and Dave the $2.75 dinner. What was the total cost of the meal?

A) $4.70 B) $5.65 C) $6.55 D) $6.75 E) Answer not given

70. Boyd is saving 30¢ each week to buy a pocket knife. The knife costs $1.50. If he now has 90¢, how many more weeks must he wait before he can buy the knife?

A) 5 B) 3 C) 2 D) 8 E) Answer not given

71. Dan paid $2.04 for a roll of color film. The cost included developing the film and making one print for each of the 12 pictures. How much did each color picture cost?

A) 17¢ B) 18¢ C) 22¢ D) 12¢ E) Answer not given

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72. Sam's train cost $24.95. He made a down payment of $4.95 and paid the balance at $5.00 per month. How many months did it take Sam to finish paying for the train?

A) 6 B) 5 C) 4 D) 3 E) Answer not given

73. During one 2-week pay period, Joe's brother earned $133.60. If his employer deducted $2.25 for hospital insurance, $2.67 for social security, and $9.10 for federal withholding tax, what was the net amount of his check?

A) $119.58 B) $119.68 C) $129.58 D) $147.62
E) Answer not given

74. Chris's dog, Barney, now weighs 18¼ pounds. He weighed only 15½ pounds when Chris got him. How many pounds has Barney gained?

A) $2\frac{3}{4}$ B) $3\frac{1}{2}$ C) $3\frac{3}{4}$ D) $33\frac{3}{4}$ E) Answer not given

75. Chris feeds Barney 1½ cans of dog food each day. If the dog food Chris buys is priced at 2 cans for 31¢, how much does it cost to feed Barney for 8 days?

A) $1.24 B) $1.86 C) $3.72 D) $2.48 E) Answer not given

76. Chris built a pen 20 feet long and 14 feet wide for Barney. He enclosed the pen with 4-foot wire costing 16½¢ per foot. What was the total cost of the wire?

A) $5.61 B) $11.22 C) $46.20 D) $10.88 E) Answer not given

77. Chris used 7 boards, each 48 inches long and 5$\frac{5}{8}$ inches wide, to build a raised platform for Barney. If he made the platform 48 inches long, how many inches wide was it?

A) 35 B) 35$\frac{5}{8}$ C) 39$\frac{3}{8}$ D) 315 E) Answer not given

78. After selling his house, Mr. Jones paid the realty company 5% commission on the sale price of $10,500. After he had paid the commission, what was the net amount that Mr. Jones received for the house?

A) $9975 B) $10,075 C) $11,025 D) $525 E) Answer not given

79. In a recent year, the winner of the Ohio high school basketball tournament won 23 of the 26 games played during the season. To the nearest tenth, what per cent of its games did the team win?

A) 88.5 B) 88.4 C) 87.0 D) 88.0 E) Answer not given

80. The starting five for the Galion basketball team had heights of 6 ft. 2 in., 6 ft. 1 in., 6 ft 8 in, 5 ft. 11 in., and 6 ft. What was the team's average height?

A) 6 ft. B) 6 ft. 1 in. C) 6 ft. 2 in. D) 5 ft. 11 in. E) Answer not given

If finished, go back and check your work

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APPENDIX 3

WARNER'S INDEX

WARNER'S REVISED SCALE FOR RATING OCCUPATION

RATING 7

Professionals: Lawyers; doctors; dentists; engineers; judges; high school superintendents; veterinarians; ministers (graduated from divinity school); chemists, etc., with postgraduate training; architects.
Proprietors and Managers: Businesses valued at $75,000 and over.
Businessmen: Regional and divisional managers of large financial and industrial enterprises.
Clerks and Kindred Workers, etc.: Certified public accountants.
Manual Workers: None in this rating.
Protective and Service Workers: None in this rating.
Farmers: Gentlemen farmers.

RATING 6

Professionals: High school teachers; trained nurses; chiropodists; chiropractors; undertakers; ministers (some training); newspaper editors; librarians (graduate).
Proprietors and Managers: Businesses valued at $20,000 to $75,000.
Businessmen: Assistant managers and office and department managers of large businesses; assistants to executives; etc.
Clerks and Kindred Workers, etc.: Accountants; salesmen of real estate; salesmen of insurance; postmasters.
Manual Workers: None in this rating.
Protective and Service Workers: None in this rating.
Farmers: Large farm owners: farm owners.

RATING 5

Professionals: Social workers; grade school teachers; optometrists; librarians (not graduate); undertakers' assistants; ministers (no training).
Proprietors and Managers: Businesses valued at $5,000 to $20,000.
Businessmen: All minor officials of businesses.
Clerks and Kindred Workers, etc.: Auto salesmen; bank clerks and cashiers; postal clerks; secretaries to executives; supervisors of railroad, telephone, etc.; justices of the peace.
Manual Workers: Contractors.
Protective and Service Workers: None in this rating.
Farmers: None in this rating.

RATING 4

Professionals: None in this rating.
Proprietors and Managers: Businesses valued at $2,000 to $5,000.
Businessmen: None in this rating.
Clerks and Kindred Workers, etc.: Stenographers; bookkeepers; rural mail clerks; railroad ticket agents; people in dry goods stores; etc.
Manual Workers: Factory foremen; electricians; plumbers; carpenters; watchmakers (own businesses).
Protective and Service Workers: Dry cleaners; butchers; sheriffs; railroad engineers and conductors.
Farmers: None in this rating.

RATING 3

Professionals: None in this rating.
Proprietors and Managers: Businesses valued at $500 to $2,000.
Businessmen: None in this rating.
Clerks and Kindred Workers, etc.: Dime store clerks; hardware salesmen; beauty operators; telephone operators.
Manual Workers: Carpenters; electricians (apprentice); timekeepers; linemen, telephone or telegraph; radio repairmen; medium-skill workers.
Protective and Service Workers: Barbers; firemen; butcher's apprentices; practical nurses; policemen; seamstresses; cooks in restaurants; bartenders.
Farmers: Tenant farmers.

RATING 2

Professionals: None in this rating.
Proprietors and Managers: Businesses valued at less than $500.
Businessmen: None in this rating.
Clerks and Kindred Workers, etc.: None in this rating.
Manual Workers: Moulders; semiskilled workers; assistants to carpenters; etc.
Protective and Service Workers: Baggage men; night policemen and watchmen; taxi and truck drivers; gas station attendants; waitresses in restaurants.
Farmers: Small tenant farmers.

Rating 1

Professionals: None in this rating.
Proprietors and Managers: None in this rating.
Businessmen: None in this rating.
Clerks and Kindred Workers, etc.: None in this rating.
Manual Workers: Heavy labor; migant work; odd-job men; miners.
Protective and Service Workers: Janitors; scrubwomen; newsboys.
Farmers: Migrant farm workers.

APPENDIX 4

RAW SCORES

KEY CODE TO THE RAW SCORES

Full Pages -- Card No. 1

Partial Pages -- Card No. 2

Column	Scores	Card(s)
1	Student I.D.--grade, method, number	1 & 2
2	I.Q.	1
3	Stanford Computations Pretest	1
4	Stanford Concepts Pretest	1
5	Stanford Applications Pretest	1
6	Stanford Total	1
7	Stanford Reading Pretest	1

ATTITUDE TEST 1

		Card	
	Question	Pretest	Posttest
8	A	1	2
9	B	1	2
10	C,D,E,F	1	2
11	G	1	2
12	H	1	2
13	I	1	2
14	J	1	2
15	K	1	2
16	L	1	2
17	Attitude Test 2 (Dutton)	1	2
18	S.E.S.	1	
19	Part A -- Project Pre-test	1	
20	Part B -- Project Pre-test	1	
21	Part C -- Project Pre-test	1	
22	Total -- Project Pre-test	1	
23	Part A -- Project Posttest	1	
24	Part B -- Project Posttest	1	
25	Part C -- Project Posttest	1	
26	Total -- Project Posttest	1	
27	Stanford Computations Posttest	1	
28	Stanford Concepts Posttest	1	
29	Stanford Applications Posttest	1	
30	Stanford Total Posttest	1	
31	Stanford Reading Posttest	1	

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                                              COLUMN
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81003118 352822085 34 3236168443643373937101 6 2928137029261671   343124089 41
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73096							403114138343129293311														
73097							3643150434339313643113														